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ABSTRACT

This report contains abstracts of new technical reports and other documents resulting from research supported by the directorate for Applied Science and Research Applications of the National Science Foundation. Research reports from current programs include work in the areas of public policy and regulation; public service delivery and urban problems; physical, mathematical and engineering applications; geophysical and environmental applications; earthquake hazards mitigation; chemical threats to man and environment; alternate biological sources of materials; and intergovernmental science and public technology. Reports from previously supported research include energy systems, fire research, weather modification, nonrenewable resources, and symposium proceedings. (BB)

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NSF/RA-790012

APPLIED SCIENCE AND RESEARCH APPLICATIONS

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March 1979

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Introduction

This report contains abstracts of new technical reports and other documents resulting from research supported by the Directorate for Applied Science and Research Applications (ASRA) of the National Science Foundation. These citations have been compiled to alert members of the scientific and technical community to current research results.

The Directorate for Applied Science and Research Applications (ASRA) was established in February 1978 as a result of an extensive reorganization of the Foundation's applied research programs. The goal of ASRA is to increase the contribution of science and technology to the Nation by identifying and supporting research and related activities having the highest potential for contribution to the understanding and resolution of significant problems. ASRA both replaces and incorporates many of the functions of its predecessor, the Directorate for Research Applications, and its Research Applied to National Needs (RANN) program. A description of the major ASRA program elements and objectives is provided in Appendix A.

ASRA awards grants and contracts for research projects within its areas of program interest. ASRA recognizes the importance of ideas for projects generated by the research community itself and therefore makes numerous awards based on unsolicited proposals. In addition, proposals in areas of priority concern are solicited from the research community.

To receive proposal solicitations or to obtain further information on submitting proposals, please contact the appropriate ASRA division, or:

Programs and Resources Officer
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and Research Applications
National Science Foundation
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Documents cited in Recent Research Reports may be ordered from the National Technical Information Service (NTIS), Document Sales, U.S. Department of Commerce, Springfield, Virginia 22161. Please refer to the NTIS accession number when ordering.

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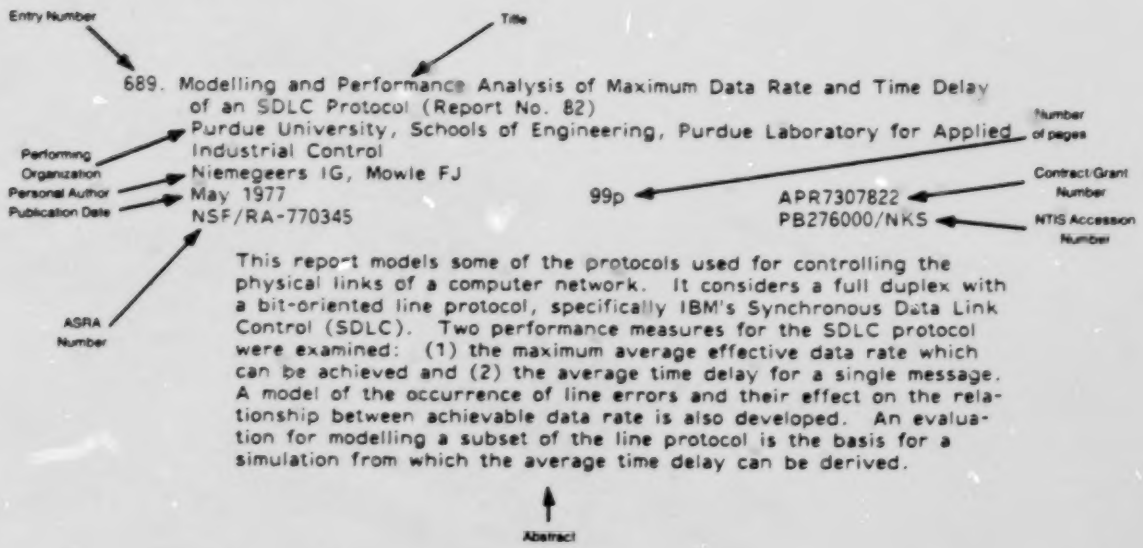

Entry Number
Title
689. Modelling and Performance Analysis of Maximum Data Rate and Time Delay of an SDLC Protocol (Report No. 82)
Performing Organization
Purdue University, Schools of Engineering, Purdue Laboratory for Applied Industrial Control
Personal Author
Niemegeers IG, Mowle FJ
Publication Date
May 1977
Number of pages
99p
Contract/Grant Number
APR7307822
NTIS Accession Number
PB276000/NKS
NSF/RA-770345
ASRA Number
This report models some of the protocols used for controlling the physical links of a computer network. It considers a full duplex with a bit-oriented line protocol, specifically IBM's Synchronous Data Link Control (SDLC). Two performance measures for the SDLC protocol were examined: (1) the maximum average effective data rate which can be achieved and (2) the average time delay for a single message. A model of the occurrence of line errors and their effect on the relationship between achievable data rate is also developed. An evaluation for modelling a subset of the line protocol is the basis for a simulation from which the average time delay can be derived.
Abstract

Information on NSF Applied Science and Research Applications Directorate reports may be obtained by writing to

Ms. Carmeen P. Adams
ASRA Information Resources
Room 1108
1800 G Street, NW
Washington, DC 20550
Telephone (202) 634-4333.

Citations are arranged in broad subject categories. Entry numbers are assigned consecutively beginning with the first issue, published in October 1976. Indexes following the main body provide access by subject, performing organization, ASRA number, contract/grant number, and author and refer to the entry number of the document.

RESEARCH REPORTS FROM CURRENT PROGRAMS

Applied Social and Behavioral Sciences

Public Policy and Regulation

656. Kentucky Department of Revenue Real Estate Assessment and Land Records Systems Research Project Phase 1 Final Report, Sections Included: 5-6
Kentucky Department of Revenue Real Estate Assessment and Land Records
1976 145p APR7420487
NSF/RA-761620 PB286799/NKS

A state-of-the-art real estate assessment system was developed for use by assessment agencies. The system is generalized so that it provides all the processes and many of the methods required in any agency. In its design structure, functions are independent of each other. Alternative functions are provided for those that vary slightly in methods used. A "table system" is provided for those functions whose methods vary to a large degree, and the functions that cannot be generalized are segregated from the other functions. Section 5 describes the four primary design concepts and includes a summary of software standards used in the system. Section 6 describes the real estate systems design which is composed of the following interrelated parts: a conceptual design; initial and detail functional designs; and an information program design. The report includes many examples in each area.

Abstracts of Sections 1-4 were presented in Recent Research Reports, August 1978. See Entries 585-591.

657. Forecasting the Effects of Consumer Affairs, Phase 1, Final Report, Analysis
Forecasting International, Ltd.
Cetron MJ, Visenoff N, Clayton A, et al
October 12, 1976 232p APR7516374
NSF/RA-770002 PB276183/NKS

This study attempts to improve the quality and quantity of information available to assist U.S. decision-makers in their long-range planning in consumerism. Presented is an examination of the evolution and diffusion of significant innovative practices, regulations, attitudes, and social values using Sweden as an example of consumerism. By studying early Swedish developments in consumerism, the authors recognized trends which may or may not be desirable. In

Phase One, it is found that Sweden tends to experience such innovations earlier than the United States; the rate of diffusion in cases where developments are exactly comparable can be described mathematically, in terms of a relationship between lag time and elapsed time; in other areas the paths of national experience are parallel rather than coincident; and this lag time is decreasing in all cases examined.

658. Decentralizing City Government, An Evaluation of the New York City District Manager Experiment (Lexington Books, D.C. Heath and Company)
Columbia University
Barton AH, Fainstein NI, Fainstein SS, et al
1977 295p APR7203366
NSA/RA-770006 PB274295/NKS

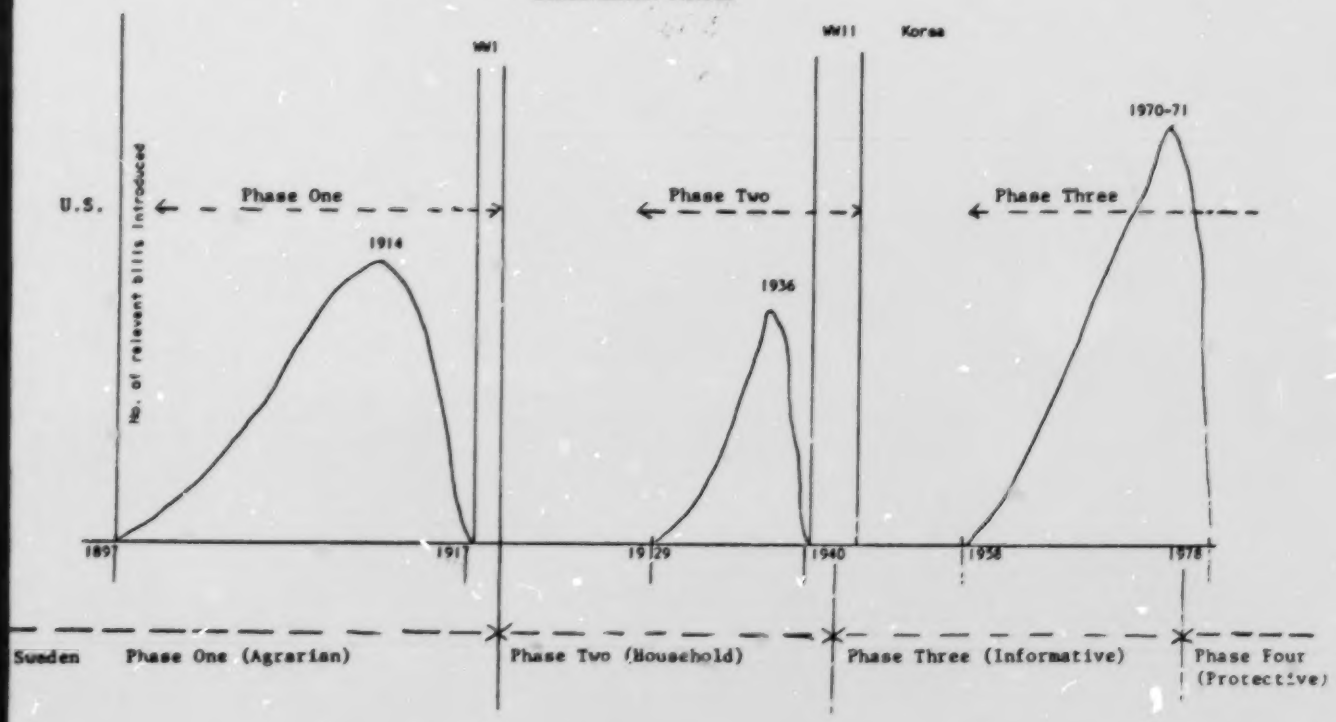
New York City's Office of Neighborhood Government demonstration attempted to create a small urban unit of government with a devolution of power to the neighborhood level to provide better delivery of city services and to encourage citizen participation. Results are presented so that the policymaker, citizen, or student of public administration can assess the potential of decentralization and local coordination of service management within large governmental units. The project had four main components: (1) The administrative analysis component examined the organizational structure and actual implementation of the district manager-district cabinet experiment in the first five districts; (2) The service delivery and cost analysis component recorded the results of 65 projects of interdepartmental cooperation, measured the costs of operating the district manager offices and the central Office of Neighborhood Government, and gathered data from 8 city departments on allocation of resources to all 62 Community Planning Districts; (3) The leadership study component surveyed 350 community leaders in 1972, interviewed selected community leaders and local officials participating in district cabinets in 1973, and resurveyed community leaders in 1974; and (4) The public survey component interviewed 1,683 residents of 7 Community Planning Districts in 1972.

659. Cost Allocation Alternatives with Particular Applications to Telecommunications
Temple University
Bowman GW, Blackstone EA, Cottrell JL, et al
May 1977 175p AER7619503
NSF/RA-770141 PB274962/NKS

This study reviewed 199 published books and articles on cost allocation with respect to their applications to telecommunication. The sources, drawn from economic, accounting, regulatory, and other areas, are described in an annotated bibliography. From these, 52 cost allocation schemes were distilled, described, and rated. The authors argue that the cost allocation problem is the pricing problem and is, therefore, of considerable importance. In competitive markets the forces of competition resolve the cost allocation problem in a manner consist-

EXHIBIT 20

CONSUMERISM PHASES



See Entry 657

ent with economic efficiency and some equity concepts. In regulated industries the cost allocation process is not generally solved by the market and is a central issue of regulatory concern. Fifty-two cost allocation methods are classified in terms of whether or not they are based on marginal cost.

660. Computer Program Documentation for Federal Milk Marketing Order Policy Simulator - Model A (Station Bulletin No. 164)
Purdue University, Department of Agricultural Economics, Agricultural Experiment Station
Banker DE, Babb EM, Goldman O, et al
June 1977 255p APR7516815
NSF/RA-770190 PB275893/NKS

A policy simulator was designed to analyze the consequences of changes in Federal milk marketing order provisions. This publication contains a documentation of the computer programs developed for the simulator. included are listings of the programs, variable name listings, input forms, use of input forms, keypunching instructions, sample model input and output, and a description of the milk marketing system and its representation as a network.

661. Simulation Model for Resource Policy Evaluation (Revised Version, No. 77-28)
Cornell University, Department of Agricultural Economics; New York State College of Agriculture and Life Sciences
Tyner WE, Kalter RJ
September 1977 52p SIA7421846
NSF/RA-770323 PB275938/NKS

This report provides detailed specification and description of a model that can be used to evaluate certain policy questions pertaining to various resources located on the public domain. The generalized leasing model (GEN2) described incorporates many factors important for public policy decisions into a framework of private market behavior. It is designed to determine the impacts of many alternative federal policies aimed at reducing risk for private resource development. A wide range of leasing policy alternatives is also incorporated into the model so that it may be used to analyze the effects of alternate leasing strategies. The generalized model described can be applied to any resource. It utilizes exogenously supplied estimates of reserves on an individual or group of leaseholds, along with estimates of the associated production costs (investment and operating) and market prices to determine the after tax net present value of the leasehold. It determines the productive capacity to be installed on the leasehold and the length of time that capacity is used. Uncertainty with respect to the key variables supplied exogenously (reserves, production costs, and market prices) is incorporated via use of Monte Carlo simulation.

662. Applied Research on the Benefits and Costs of Public Regulation of the Copper Wire Industry, Volume 1: Technical Report
Harbridge House, Inc.
Sheldon N, Dorenfeld A, McKittrick S
August 1977 347p C7618549
NSF/RA-770331 PB275885/NKS

This study examined the impact on the copper-wire industry of federal, state and local regulations as they generate benefits and costs, including the effects on the price and supply of copper wire to the consumer. Objectives were to measure and evaluate the effects of regulation on productivity, performance, and social welfare and to provide an examination and analysis to enable legislators to increase the overall social effectiveness and equity of regulations. Methodology consisted of five features: (1) treatment of the cost and benefit gradients of more or less stringent levels of regulation; (2) the assessment of the relative or marginal effectiveness of individual regulation when applied as part of a total regulatory environment; (3) an assessment of the cumulative impact of different regulations, spanning the stages of copper-wire production, different points in time, and different types of benefits and third parties; (4) expression of benefits in terms of natural dimensions or consequences (lives saved), to prevent the biases that result when benefits are collapsed into money values; and (5) vectors of different costs and benefits defined as an efficiency frontier. Topics covered in the data base volume are (1) regulatory forecasting; (2) data base for engineering, production, and cost functions; (3) industry financial and pricing data; (4) copper resources in federal lands; and (5) community profile data.

663. Applied Research on the Benefits and Costs of Public Regulation of the Copper Wire Industry (Data Base)
Harbridge House, Inc.
August 1977 406p C7618549
NSF/RA-770333 PB276210/NKS

See entry 662 for abstract.

664. Benefits and Costs of Public Regulation of the Production, Processing, and Distribution of Ground Beef, Executive Summary
Colorado State University
Roselius T, Berry R, Hasty RW, et al
August 1977 23p APR7618473
NSF/RA-770340 PB275894/NKS

See entry 665 for abstract

665. Benefits and Costs of Public Regulation of the Production, Processing, and Distribution of Ground Beef, Final Report
Colorado State University
Roselius T, Berry B, Hasty RW, et al
August 1977 316p APR7618473
NSF/RA-770341 PB276725/NKS

The objective of this project was to design and demonstrate scientific procedures for measuring the net cumulative costs and benefits of public regulation as it affects ground beef, and to identify major issues for debate. Major stages in the ground beef production/distribution system are defined, from the landbase through to consumption, including major elements of consumption. Colorado was selected as a study base because it includes all stages of the ground beef production/distribution system. Methodology consisted of: (1) identifying regulatory benefits for consumer, labor, industry, agency and society in general; (2) determining regulation costs to be either enforcement costs or compliance costs; (3) designing and analyzing alternative methods for measuring each kind of cost and benefit; and (4) creating a trial run of the most promising methods in order to provide a preliminary estimate of costs and benefits, and to identify major problems of measurement techniques. The bibliography volume provides a selected listing of materials relevant to the project. References are followed by annotations of most of the materials deemed useful for other researchers.

666. Benefits and Costs of Public Regulation of the Production, Processing, and Distribution of Ground Beef (Bibliography)
Colorado State University
Roselius T, Berry B, Hasty RW, et al
August 1977 80p APR7618473
NSF/RA-770342 PB275892/NKS

See entry 665 for abstract.

667. Public Regulation of Financial Services Costs and Benefits to Consumers, Volume 1, Phase 1 (Interim Report, Report No. 77-94-A)
Abt Associates, Inc.
Heggestad AA, Mingo JJ
1977 172p C7618548
NSF/RA-770343 PB276186/NKS

The costs and benefits to consumers of the regulation of consumer financial services are evaluated. Phase 1 of this two-phase study presents a descriptive analysis of the industry and the laws and regulations that affect it, chooses regulations for study in Phase 2, and develops the appropriate methodology and data bases for their evaluation. Research projects discussed in Volume 1 represent proposals for research in Phase 2: (1) "Production of Consumer Financial Services"; (2) "Proposals for Regulatory Reform in the

Consumer Financial Services Sector: A Survey"; and (3) "Regulation of Financial Institutions: An Overview." Volume 2 presents (1) the effect of market structure on the prices of demand deposits, savings deposits, and consumer loans; (2) the argument that regulation and market concentration may be interrelated variables; (3) several unanswered questions about the economic impact of deposit rate ceilings; (4) a concept of discrimination, an analytical framework used to study it, and a theory of discrimination in credit granting; (5) findings from the review of the relevant literature on credit disclosure legislation and consumer shopping behavior; (6) the impact of portfolio restrictions upon bank behavior; and (7) soundness levels for a large sample of commercial banks. A comprehensive bibliography of relevant research is included.

668. Public Regulation of Financial Services--Costs and Benefits to Consumers, Volume 2, Phase 1 (Interim Report, Report No. 77-94-B)
Abt Associates, Inc.
Heggestad AA, Mingo JJ
1977 275p C7618548
NSF/RA-770344 PB276187/NKS

See entry 667 for abstract.

669. Evaluation of the CELNDX Program Developed at Oak Ridge National Laboratory
University of Colorado, Graduate School of Business Administration
Frendewey JO Jr, Monarchi DE, Taylor RH
October 15, 1977 33p AEN7617062
NSF/RA-770371 PB275255/NKS

The CELNDX Program is one of a series of programs and models developed by Oak Ridge National Laboratories (ORNL) for the purpose of analyzing the impact of population and employment activities on a particular geographic region. CELNDX is the result of a study carried on within the data management and computational systems area. Its purpose is (1) to manipulate variables in a spatially distributed cellular data base and (2) to synthesize these spatial variables into abstract variables called indices. These indices are computed as weighted linear sums of specific data contained within a cellular data base. This report contains an evaluation of the CELNDX program in terms of its conceptual design, implementation of the concepts presented, and the actual program code. Also included is a brief evaluation of the documentation provided, in terms of both its correspondence to the actual program and its usefulness to potential users of CELNDX.

670. Implementation of a Socio-Economic Model in a Rural Area: User Needs and Perceptions (State ID No. 76-270210-282)
University of Colorado, Graduate School of Business Administration
Monarchi DE, Homerding GL, Taylor RH
October 15, 1977 30p AEN7617062
NSF/RA-770373 PB275242/NKS

This report describes an implementation exercise in which a relatively simple socio-economic simulation model was parameterized in a rural county in Colorado for the purpose of exploring implementation problems with unsophisticated users. Particular attention was paid to (1) education aspects/requirements of the users; (2) modelling perceptions of the local individuals; (3) model needs of the users; (4) procedures for eliciting subjective parameter estimates from local individuals; (5) man/program interface requirements of unsophisticated users; and (6) output display preferences. The over-riding conclusion from this research is that any model which has a hope of being used or communicated to unsophisticated individuals must have two human-engineering characteristics associated with it, irrespective of the content of the model. (1) It is desirable that a technically unskilled individual can both create and modify the basic data sets required by the model, preferably in an interactive mode, and furthermore that scenarios too can be created and modified again in an interactive mode. (2) The model must have the ability to produce graphical results for ease of communication and for rapid interpretation of alternative scenarios.

671. Role and Conduct of Users Seminars in the Transfer of Modeling Technology... The Colorado Experience (State ID No. 76-270210-282)
University of Colorado, Graduate School of Business Administration
Taylor RH, Monarchi DE, Homerding G, et al
October 15, 1977 62p AEN7617062
NSF/RA-770374 PB275250/NKS

This report summarizes the conduct of and conclusions resulting from two seminars on model utilization held at the University of Colorado during 1977. The first seminar, on February 11, was oriented towards introducing potential users to modeling technology. Primary emphasis was placed on the historical development and current status and capabilities of socio-economic modeling systems. A two-day seminar on August 25-26 was designed to give users practical experience in the development of alternative future scenarios and the conversion of these qualitative statements into quantitative parameters and coefficients for use in simulation models. A combination of lecture, group discussions, and on-line computer experience was used in presenting these concepts. In this report a discussion of alternative seminar objectives and philosophies is followed by a presentation of the details of the two Colorado seminars. The final section of this report contains conclusions and recommendations based on the experiences of the Colorado Research Team.

672. Models Transfer Project, Final Report (State ID No. 76-270210-282)
University of Colorado, Graduate School of Business Administration
Monarchi DE, Taylor RH
October 15, 1977 19p AEN7617062
NSF/RA-770375 PB275252/NKS

This research develops preliminary criteria for defining technically "good" socio-economic models and explores the implementation problems of simple socio-economic models with unsophisticated users to define "good" models from their point of view. The first objective is based on the development of a "proving ground" for socio-economic models. This would permit the analysis and comparison of models developed for the National Science Foundation and other organizations. The analysis using the "proving ground" would provide insights into desirable qualities for these types of models, both in relationship to each other and from an overall technical point of view. The second objective is addressed in two ways. First, two seminars would be presented to a group of technical planners at the regional level within the state. Second, an actual implementation of a simple socio-economic model would be performed in a rural county in Colorado. Successes and failures of the research team are described. A complete discussion of the various topics is contained in the reports listed at the end of this paper.

673. Conclusions Regarding the Use of the "Proving Ground" Concept in Evaluating Socio-Economic, Land-Use, and Environmental Models, Final Report
University of Colorado, Graduate School of Business Administration
Duea RW Jr, Frendewey JO Jr, Monarchi DE, et al
October 15, 1977 23p AEN7617062
NSF/RA-770376 PB275271/NKS

This paper presents conclusions regarding the use of the "proving ground" concept to evaluate socio-economic, land-use, and environmental models. One of the goals is to establish and use such a "proving ground." The conclusions are based both on that experience and on the research team's previous experiences with model transfer and evalution. Each of the tasks associated with the establishment and use of a "proving ground" is reviewed here. Tasks involved in establishing a "proving ground" include defining types of models to be evaluated, selecting a test area, and designing the data base. Tasks involved in using the "proving ground" include conducting a preliminary screen of the model to be evaluated; obtaining the model; reviewing the received model; determing the data requirements of the model; collecting necessary data and preparing the data for use by the model; implementing the model's computer program; running, debugging, and calibrating the model with supplied test data and test site data; and evaluating the model on the basis of experience gained in all the above tasks and comparing it with similar models previously evaluated.

674. General Guidelines Regarding the Transferability of Computer-Based Socio-Economic, Land-Use, and Environmental Models
University of Colorado, Graduate School of Business Administration
Frendewey JO Jr, Duea RW Jr, Monarchi DE, et al
October 15, 1977 11p AEN7617062
NSF/RA-770377 PB275254/NKS

A set of modeling guidelines, based on the experience of this research team in implementing socio-economic, land-use, and environmental models, is presented. The discussion focuses primarily on the characteristics of a large computer-based model that make it portable and easily transferable from one site to another. The guidelines presented here are divided into two sets: those at a macro level, such as documentation, and those at the micro level dealing more specifically with programming considerations.

675. Evaluation of the Subregional Land-Use Allocation Model, Final Report (State ID No. 76-270210-282)
University of Colorado, Graduate School of Business Administration
Duea RW Jr, Monarchi DE, Taylor RH
October 15, 1977 98p AEN7617062
NSF/RA-770378 PB275243/NKS

This paper presents a conceptual evaluation of SUBREGION and examines the implemented version of the model. Primarily, the model attempts to allocate changes in regional employment to the subregions. In conjunction with this effort, some population adjustments are computed for the migration of workers. Performed in two stages, this evaluation (1) examines and appraises the SUBREGION model as it is conceptually described in the Oak Ridge National Laboratory (ORNL) documentation and (2) examines ORNL's implementation of the model. Where appropriate, comparisons are made between the definition of the model, the objectives of the conceptual version, and the performance of the model that was implemented. Parts 1 and 2 of the report evaluate the conceptual and implemented versions of the model. An appendix provides a detailed list of the errors and deficiencies found in the programming of the implemented model.

676. Selected Aspects of Consumer Behavior: A Summary from the Perspective of Different Disciplines
University of Illinois
Ferber R
1977 531p GI38971
NSF/RA-770013 PB275947/NKS

This book provides an overview from various disciplines of what is known about consumer behavior in the marketplace. Part 2 presents economic and psychological theories of consumer choice. Part 3 reviews what is known about different forms of consumer behavior in the marketplace and includes (1) decision-making in the household--how consumer choice is manifested in the actions of the family unit; (2) patterns of marriage and family formation and dissolution; (3) mobility (geographical, educational, and occupational); (4) saving trends; (5) consumer purchases of durable and nondurable goods; (6) new products and ideas; (7) brand choice; (8) shopping behavior and preferences; and (9) life styles. A comprehensive overview of the different ways in which psychological factors influence consumer choice is presented. Factors such as television advertising, promotional methods, and the role of price in consumer choice are discussed. The final chapters deal with aspects of the measurement and analysis of consumer behavior.

677. Evaluating the Organization of Service Delivery: Solid Waste Collection and Disposal (Summary)
Columbia University, Graduate School of Business, Center for Government Studies
August 1976 24p APR7402061
NSF/RA-770252 PB275699/NKS

In response to nationwide concern about productivity in local government, a large-scale, intensive, nationwide study of solid-waste management (both collection and disposal) was conducted. The decision-related research on solid-waste collection is concerned with the extent of use of the different organizational arrangements in metropolitan areas; the political characteristics of communities that utilize the various organizational arrangements; the legal conditions and the policy environment created by the Federal and State governments for organization of service delivery; the effect of different financing modes on solid-waste collection services; the cost structure of providing collection services; and the efficiency of alternative organizational arrangements for residential solid-waste collection. Research activities concerning solid-waste disposal and legal conditions include the policy environment created by the Federal and State governments with respect to the organization of refuse disposal activities; new technologies in resource recovery; organizational arrangements to finance solid-waste disposal facilities; and regulatory roles of local governments.

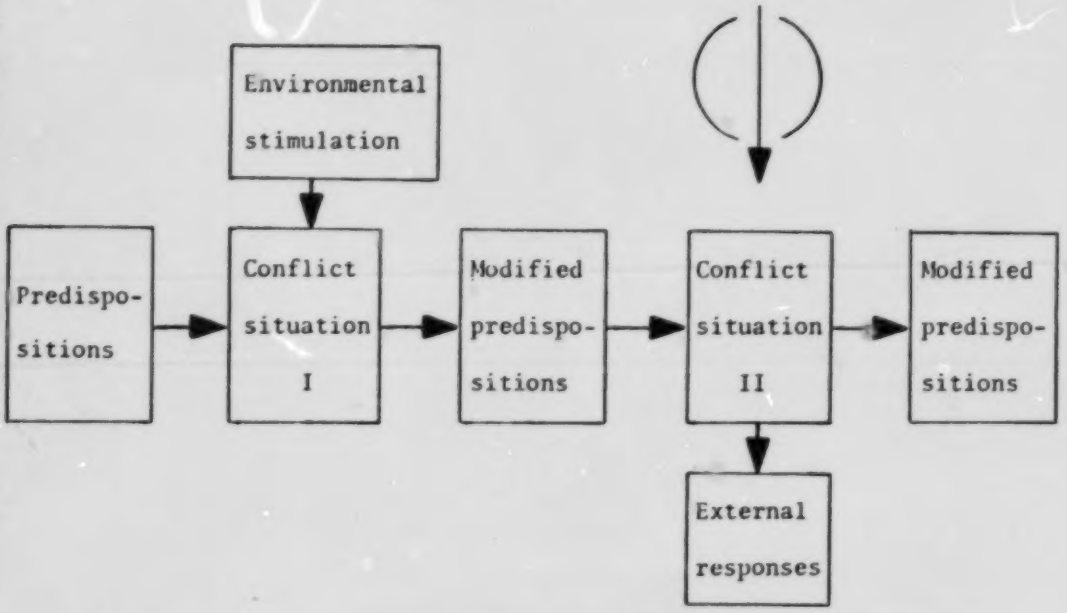


Fig. 3.2 The Relationship between Environmental Stimulation at One Point in Time and a Choice Made in a Subsequent Conflict Situation.

See Entry 676

678. Attitudes, Beliefs, and Transportation Behavior (Urban Travel Demand Forecasting Project, Phase 1 Final Report Series, Volume 6, Research Report UCB-ITS-RR-77-12)
University of California at Berkeley, Institute of Transportation Studies
Johnson MA
August 1977 100p GI43740
NSF/RA-770281 PB274317/NKS

This volume describes several studies based substantially on subjective data reflecting travelers' beliefs, attitudes, and intentions. Research topics were (1) the importance of various travel attributes as they influence choices among car, bus, and BART commuting, and (2) attitudes reflecting basic preferences for auto and transit travel. Chapter 1 presents definitions of beliefs, attitudes, and intentions for use throughout the text and it discusses the relationships of the concepts to each other, to objective measures of physical phenomena, to the concept of utility, and to behavior. Chapter 2 describes a study of 10 different travel attributes and their relative influence on choices among car, bus, and BART for traveling to work in the San Francisco Bay area. Attributes include cost, total travel time, dependability, relaxation, safety from accidents, use of time while traveling, flexibility, seat availability, safety from crime, and waiting time. Chapter 3 describes two studies of attitudes related to the basic characteristics of auto and transit travel that do not vary substantially for different trips. References, tables, and figures are included.

679. Forecasting Travel Demand in Small Areas Using Disaggregated Behavioral Models: A Case Study (Urban Travel Demand Forecasting Project, Phase 1 Final Report Series, Volume 11)
University of California at Berkeley, Institute of Transportation Studies
Johnson MA, Adiv A
August 1977 61p GI43740
NSF/RA-770282 PB274318/NKS

The patronage of a new transit system proposed for a suburban city in the San Francisco Bay area is predicted using disaggregate behavioral models of transportation choice. Features of the study include (1) detailed transportation alternatives (the models that were used estimated the probabilities of choices among seven different travel modes); (2) calculation of time and cost data needed as input to the forecasting models with hand measurements of walk distances for each person in the sample, and descriptions of trips both inside and outside the local area; (3) a method based on iterative proportional fitting used to correct for unrepresentative sampling of the population of potential bus users; and (4) anaiyses conducted to test and compare the accuracy of the probabilities estimated by different behavioral models, using data available before the bus system was running. Implementation of the forecasting methodologies was successful. Estimated probabilities of using currently available travel modes had little relationship to current behavior, and the estimated

probabilities of using the proposed bus system had little relationship to people's intentions to use the system as reported in telephone interviews. Results suggested that the behavioral models used can be feasibly applied to travel demand forecasting in small urban areas, but that additional development and testing of the models should be done before they are used as a basis for policy decisions.

680. Alternative Food Delivery Systems: An Exploratory Assessment
Experienced Resource Group, Inc.
September 1977 308p AER7707184
NSF/RA-770298 PB275667/NKS

Alternatives or modifications to the present food delivery system may be needed if the system is to work effectively in the face of emerging economic, regulatory, and social forces. This study examines and assesses the food delivery system and its alternatives in terms of what we know about their adaptability to these emerging pressures. The study emphasizes the delivery system for fresh fruits and vegetables. Information was gathered from a review of over 2,000 publications and over 100 interviews with experts in various facets of the food delivery and marketing system. This assessment leads to the conclusion that four clusters of research needs stand out above all others. Research is needed that will reduce the energy dependence of the food delivery system, develop workable approaches to inner-city food distribution, streamline and rationalize the regulations imposed upon the food delivery system, and improve the efficiency of the delivery system.

Applied Physical, Mathematical, and Biological Science and Engineering

Physical, Mathematical, and Engineering Applications

681. Machine Tool Industry in the German Democratic Republic (DDR) and in the Federal Republic of Germany (BRD), Supplement to the Multi-Station, Digitally Controlled Manufacturing Systems Workshop (January 1977, Milwaukee, Wisconsin)
University of Wisconsin at Milwaukee
January 1977 47p APR7611416
NSF/RA-770105 PB276292/NKS

As a direct result of the Flexible Manufacturing Systems (FMS) Workshop, two projects were undertaken and are documented. First, a central information base is being established at the University of Wisconsin - Milwaukee. Second, as a result of great interest in the research and FMSs in the Federal Republic of Germany (BRD) and the German Democratic Republic (DDR), institutions in both countries were visited. The objective of the visits was to obtain an overall

summary and impression of the status of the FMS development and research. In both countries there are large, well-financed educational programs in modern manufacturing at the universities. The universities enjoy a close working relationship with industry and have actively participated in the design and implementation of FMSs, both as experimental systems in their own labs and as operational systems in industry. Information included is based on multiple interviews as well as personal observation.

682. Fifth NSF Grantees' Conference on Production Research and Technology, September 26-29, 1977, Cambridge, Massachusetts
Charles Stark Draper Laboratory, Inc.
September 1977 195p APR7418173
NSF/RA-770251 PB274157/NKS

The National Science Foundation's (NSF) Grantees' Conferences on Production Research and Technology are forums for presenting and discussing work done in a particular group of NSF-sponsored projects and closely related industrial projects. At this conference 22 papers on advanced research and development in automation and production technologies, with special reference to the discrete goods industries, were presented. The conference brought together grantees of NSF and managers, scientists, and engineers most responsible for applying research results to the increase of industry productivity. Papers cover such topics as optimal planning of computerized manufacturing systems, computer-aided injection molding system, systems engineering of hierarchy computer control systems, and exploratory research in industrial modular assembly.

683. Optimal Planning of Computerized Manufacturing Systems, Unit Machining Operations - Part 1, COFORM - A Code for Machining, Volume 1 (Report No. 5)
Purdue University, School of Industrial Engineering
Rose DW, Solberg JJ, Barash MM
July 1977 213p APR7415256
NSF/RA-770267 PB274265/NKS

COFORM (COding FOR Machining), a code that represents machined surfaces, may be used as input to computer-aided process planning systems. It describes the parameters necessary to geometrically describe a machine surface. This enables automatic process planning and selection of unit machining operations necessary to produce the described machine surface. COFORM acts as the medium through which data is passed to the Automated Process Planning and Selection (APPAS) program, which selects unit machining operations for the described machine surface. COFORM has flexibility, allowing other automated process planning and selection programs to use this simplified data entry procedure as the input medium. Since COFORM describes the specific characteristics (the machined surfaces) of the part, the complexity (and length of description) is greater than any

presently available coding scheme. COFORM is designed to supply the necessary information to algorithms that select the machine tools necessary to manufacture the specified part spectrum, along with the manufacturing processes that will produce the machined surface. Presented in Volume 1 are the structure and format of COFORM; the process for attribute default; intialization of COFORM; and data acquisition using COFORM. Appendices to Volume 1 describe the user manual and coding examples. Volume 2 appendices present flowcharts for COFORM, source listing of COFORM, data file for INIT and the resulting block data subroutine, relaxed input restriction, flowcharts and source listing for INIT, and a glossary of COFORM terminology.

684. Optimal Planning of Computerized Manufacturing Systems, Unit Machining Operations - Part 1, COFORM - A Code For Machining, Volume 2 (Report No. 5)
Purdue University, School of Industrial Engineering
Rose DW, Solberg JJ, Barash MM
July 1977 193p APR7415256
NSF/RA-770268 PB274266/NKS

See entry 683 for abstract.

685. Computer-Aided Injection Molding System (Progress Report No. 4, November 1, 1976 - August 31, 1977)
Cornell University, College of Engineering, Injection Molding Project
Wang KK, Shen SF, Stevenson JF, et al
September 1977 136p APR7411490
NSF/RA-770272 PB274275/NKS

This project applies the science of several basic disciplines to advance the state of the art of injection molding. In this attempt, injection molding is treated as a system of mold design, mold manufacture, and process control; each element involves the use of computer techniques dealing with such problems as part geometry, numerical simulation of fluid flow, process optimization, and generation of NC tape for machining. Objectives are (1) to identify and solve rheological problems of primary importance to the analysis of injection molding; (2) to develop numerical simulation schemes for predicting mold filling, packing, solidification, and, possibly, the properties of molded parts; (3) to develop experimental techniques to monitor process conditions precisely for verification of simulation models and to provide data for numerical simulation; (4) to establish quantitative guidelines for mold design, process control, and selection of equipment as a by-product of the work described above; and (5) to develop and implement an integrated CAD/CAM system to demonstrate the feasibility of automating injection molding as a system for improving productivity.

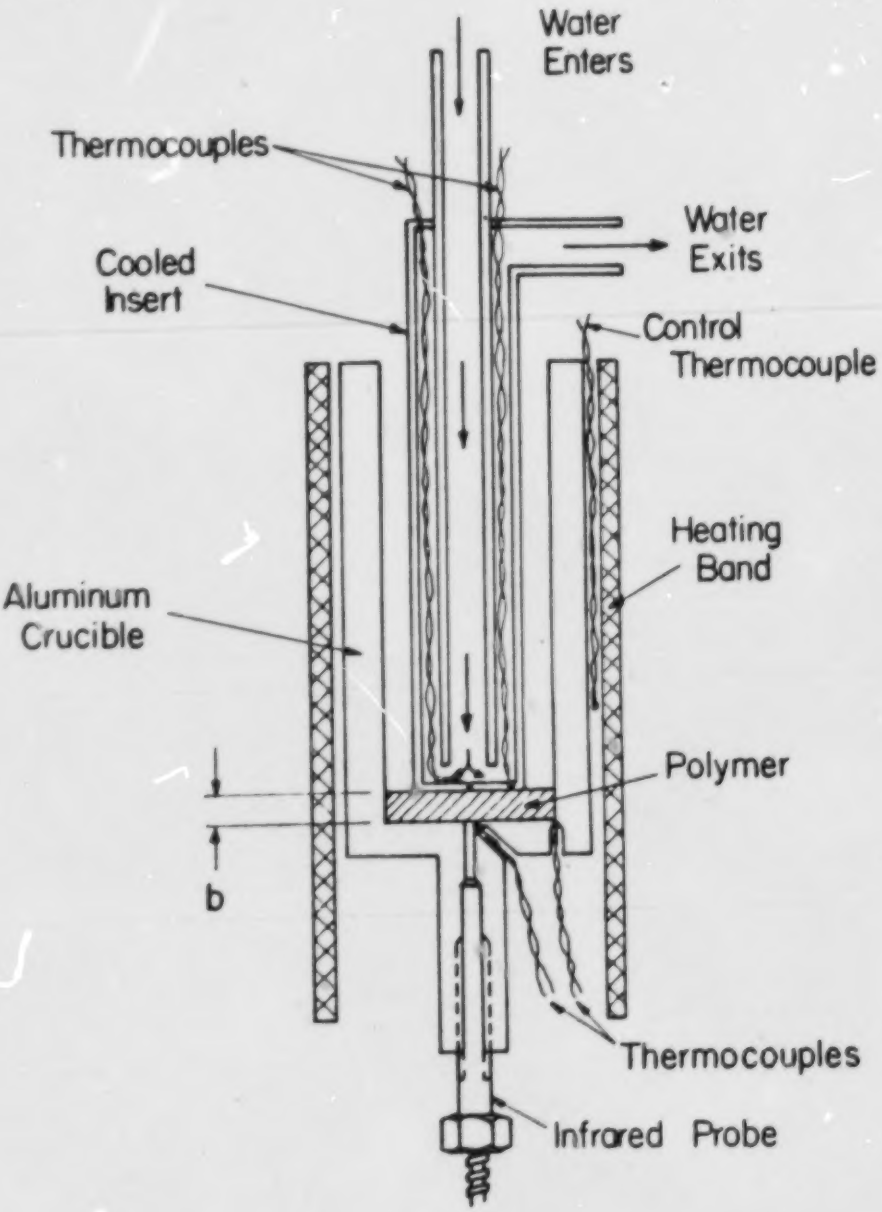


Fig. 6.8 Calibration Apparatus for Infrared Probe

See Entry 685

686. Machine Intelligence Research Applied to Industrial Automation (SRI Project 4391, Seventh Report, November 1, 1976 - July 31, 1977)
Stanford Research Institute
Rosen C, Nitzan D, Agin G, et al
August 1977 99p APR7513074
NSF/RA-770287 PB274122/NKS

This project is developing a programmable and adaptable computer-controlled system of manipulators, end-effectors, and contact or non-contact sensors that can easily be programmed to perform material-handling, inspection, and assembly tasks with the aid of joysticks, voice control, a keyboard/display terminal, and other devices. Five principal topics are discussed in this report: (1) Force Controlled Part Mating - A three-axis passive accommodation unit was developed, attached to the Unimate Wrist, and applied to assembly tasks requiring tolerance much tighter than required by the Unimate; (2) Bolting with Visual Feedback - A pneumatic bolt driver and a 100 x 100 element solid state TV camera were mounted on the z-component of the above three-axis accommodation unit to perform bolting with visual feedback by the Unimate; (3) Computer Assisted Manipulator Training - A system for training a manipulator to operate efficiently and accurately on a moving conveyor line was developed; (4) Communication in Distributed Processing - A method was developed for communication among computers in the distributed system; and (5) Training Software - Initial high-level software for programming the automation system for new tasks has been improved.

687. General Methods To Enable Robots with Vision To Acquire, Orient and Transport Workpieces, Third Report (August 15, 1976 - August 15, 1977)
University of Rhode Island
Birk J, Kelley R, Badami V, et al
1977 177p APR7413935
NSF/RA-770288 PB272720/NKS

Methods are being developed to increase the range of industrial applications of robots. The limitations in the use of humans and mechanical feeders to load machines with oriented workpieces are presented. The emphasis is to feed workpieces directly from bins or chutes. Many of the research issues are discussed separately in appendices: Appendix 1 presents a justification for research on robot workpiece feeders; Appendices 2 and 3 include descriptions of this research program; Appendix 4 describes a means to selectively acquire workpieces when substantial edge information is present; Appendix 5 discusses workpiece orientation correction with a robot arm using visual information; Appendix 6 describes the design of a software system to visually instruct robots; Appendix 7 discusses workpiece trajectory control and transportability; Appendix 8 contains triangle method experiments; Appendix 9 describes workpiece position and orientation; Appendix 10 discusses wrist design; Appendix 11 includes software descriptions; and Appendix 12 discusses the influence of workpiece symmetry upon appearance calibration.

688. Programmable Assembly Research Technology Transfer to Industry, Final Report
Westinghouse Electric Corporation, Westinghouse R&D Center; SRI International; Charles Stark Draper Laboratory, Inc.; University of Massachusetts
Abraham RG, Csakvary T, Shum LY, et al
October 31, 1977 115p ISP7624164
NSF/RA-770300 PB275671/NKS

Studies of real batch assembly operations revealed that the potential exists for a 4 to 1 productivity improvement through the successful implementation of adaptable-programmable automatic assembly systems (APAS). Such a significant productivity increase could improve our nation's competitive position and stop the exodus of batch assembly activity to foreign countries. A worldwide state-of-the-art review led to the conclusion that a good APAS technology base exists, much of it resulting from previously funded NSF/RANN programs, but there are some voids. Applied research is needed on APAS software, vision systems, programmable parts feeding equipment, and total system integration. Furthermore, significant reductions in equipment cost and cycle time are essential to increase the number of batch assembly operations that are good economic candidates for automation. The successful transfer to industry can be accelerated via a pilot program, during which a representative product line, small motors, is automatically assembled and data are gathered to conduct a technical, economic, and human resource evaluation.

689. Modelling and Performance Analysis of Maximum Data Rate and Time Delay of an SDLC Protocol (Report No. 82)
Purdue University, Schools of Engineering, Purdue Laboratory for Applied Industrial Control
Niemegeers IG, Mowle FJ
May 1977 99p APR7307822
NSF/RA-770345 PB276000/NKS

This report models some of the protocols used for controlling the physical links of a computer network. It considers a full duplex with a bit-oriented line protocol, specifically IBM's Synchronous Data Link Control (SDLC). Two performance measures for the SDLC protocol were examined: (1) the maximum average effective data rate which can be achieved and (2) the average time delay for a single message. A model of the occurrence of line errors and their effect on the relationship between achievable data rate is also developed. An evaluation for modelling a subset of the line protocol is the basis for a simulation from which the average time delay can be derived.

690. Reliability Analysis of the Proposed Hierarchical Computer Control System for Large Steel Manufacturing Complexes (Report No. 93)
Purdue University, Schools of Engineering, Purdue Laboratory for Applied Industrial Control.
Hiatt WH, Petersen CC
September 1977 213p APR7307822
NSF/RA-770346 PB276200/NKS

The proposed hierarchical computer control system is an interconnected network of computers/controllers designed to coordinate and operate a large steel production complex. This report demonstrates how reliability/availability analysis is used to assist in the design of the control system. In a brief description of the control system, the hierarchy, interconnections, redundancy, the main computer, other computers, and consoles are discussed. The GRASP simulation program and its application to U.S. Steel's computer system is summarized. An assessment of component failure and repair characteristics of the system is made, and results of the reliability analysis of the control system are presented. Two programs are presented in the appendices: (1) Disc Analysis Program and (2) GRASP Program Data for Model 8.

691. Optimal Scheduling of a Multiprocessor-Multiproduct Plant Based on Received Orders (Report No. 96)
Purdue University, Schools of Engineering, Purdue Laboratory for Applied Industrial Control
Naaseh-Shahry H, Koivo AJ
May 1977 102p APR7307822
NSF/RA-770347 PB275890/NKS

This report presents a possible approach to the problem of scheduling production according to received orders. In a multiprocessor-multiproduct plant one of the problems of production scheduling is to determine the amount of in-process inventory levels, because having an inventory will provide a fast delivery to a customer. It is desirable to follow a production schedule such that customer orders are filled as soon as possible while total production cost (including inventory cost) is kept at a minimum. This report presents a formulation of the physical constraints into mathematical terms and a feasibility study showing the application of these equations in optimal scheduling of a primary mill based on the received orders. The plant described consists of seven processors, two in-process inventories, and one final inventory. A sample problem is presented which includes schedules for 6 months. The appendices include (1) input format used in this report; (2) MPS format; (3) optimal values of constraints; and (4) optimal values of variables.

692. Dredging in Estuaries (A Guide for Review of Environmental Impact Statements, Symposium/Workshop Proceedings; March 1977, Reston, Virginia)
Research Triangle Institute; Oregon State University
Massoglia MF
March 1977 247p AEN7101908A03
NSF/RA-770284 PB274799/NKS

The purpose of this symposium/workshop was to familiarize various user groups with the Guidelines for Impact Assessment of Dredging in Estuaries prepared by Oregon State University (OSU). The guidelines provide a methodology intended to ensure that the quality of the data contained in an Environmental Impact Statement (EIS) is adequate to comply with the intent of the National Environmental Policy Act of 1969 (NEPA). The guidelines, used in conjunction with this symposium/workshop proceedings report, are intended to assist the Corps of Engineers, the Environmental Protection Agency, the Maritime Administration, estuary managers, and individuals in the extremely important process of evaluating and preparing environmental impact statements for dredging in estuaries. The symposium/workshop consists of a series of presentations by the OSU research team; four concurrent workshop sessions; presentations by individuals from public and private organizations involved in planning, decision making, regulation, and evalation of estuarine dredging; and a public session.

Earthquake Hazards Mitigation

Siting

693. Earthquake Prediction, Uncertainty, and Policies for the Future: A Technology Assessment of Earthquake Prediction, Final Report. (SRI Project EGU3471, Center for Resource and Environmental Studies, Report No. 19)
Stanford Research Institute, Center for Resource and Environmental Studies
Weishecker LW, Stoneman WE, Ackerman SE, et al
January 1977 311p GI43870
NSF/RA-770161 PB275581/NKS

The purpose of this summary report is to present--for the benefit of public policymakers and administrators, scientists, businessmen, special interest groups, private citizens, and the media--the findings of a recent comprehensive technology assessment of earthquake prediction. This assessment focuses on (1) background on earthquakes; (2) outlook for earthquake prediction; (3) responding to earthquake prediction; (4) public policy issues related to earthquake prediction; (5) regional planning for uncertain predictions; and (6) the long-term outlook.

694. Bibliography of Earthquake Engineering
Columbia University
Kanai K, Shinozuka M
August 1977 500p ENV7307756
NSF/RA-770304 PB276249/NKS

This bibliography of earthquake engineering literature includes published articles up to 1971. Main topics include (1) earthquake; (2) ground vibration; (3) ground; (4) structures; (5) earthquake damage; (6) earthquake resistant structures and design; and (7) foreign countries (seismic intensity, seismicity, earthquake damage, earthquake resistance regulations). The list contains the reference number, author's name, title of the paper, and name, volume, year, and page of the source in which the paper was published.

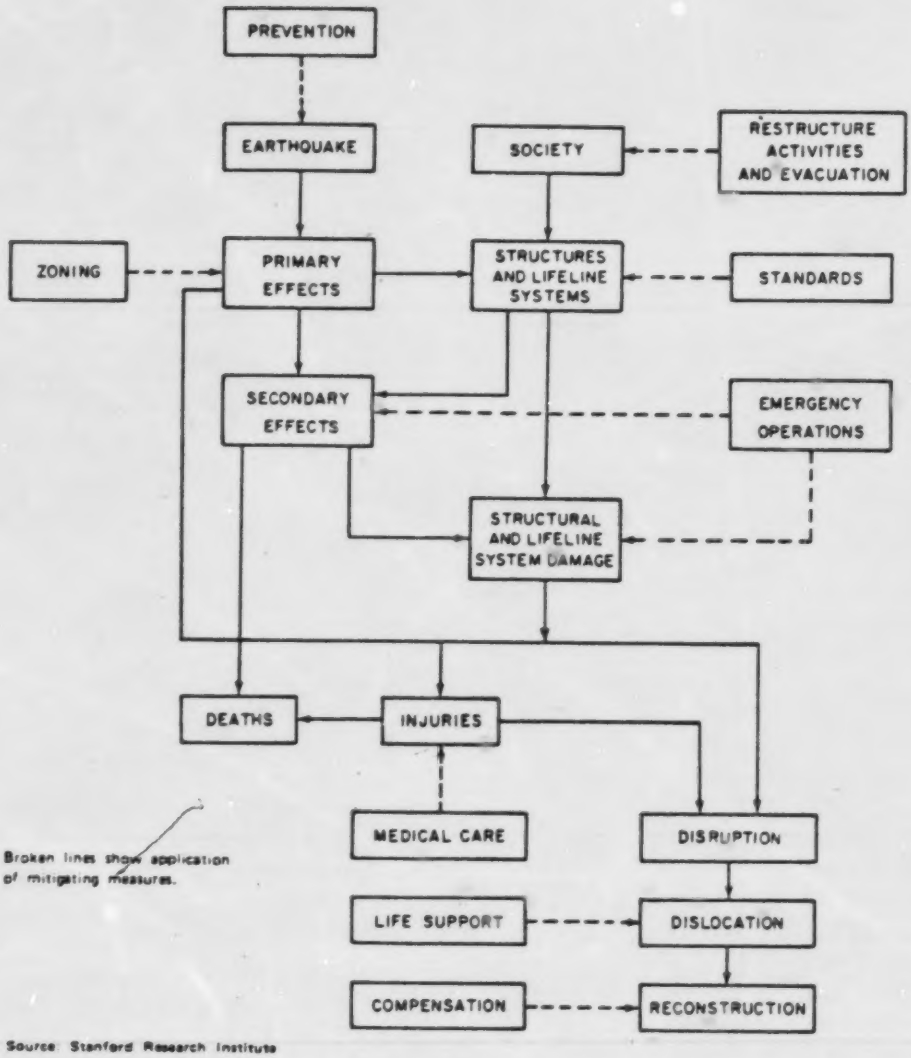


FIGURE 3 IMPACT OF EARTHQUAKE ON SOCIETY, SHOWING MITIGATING MEASURES AVAILABLE

See Entry 693

695. Bibliography of Field Studies of Major Earthquakes in Japan (Bulletin of the Earthquake Research Institute, Volume 47, 1969, pp271-394)
Columbia University, Department of Civil Engineering
Usami T, Tsuno J, Shinozuka M
August 1977 332p ENV7307756
NSF/RA-770305 PB275864/NKS

This bibliography of field studies on major earthquakes in Japan includes papers concerning the field inspection, seismometrical studies, studies of related phenomena, and investigations of damages which were published prior to the end of 1965. The list contains the following: (1) reference number; (2) author's name; (3) title of the paper; (4) name, volume, year, and page of the Bulletin in which the paper was published or the name of the publishers; (5) name and year of the earthquake studied; and (6) the main topic of the paper. Papers are classified by the year of the earthquake and by main topic. Date, name, latitude, longitude, focal depth, magnitude, and reference number of the earthquakes are arranged in a table.

696. Simulation of Strong Earthquake Motion with Explosive Line Source Arrays (Final Report, November 15, 1976 - October 15, 1977)
Stanford Research Institute
Abrahamson GR, Lindberg HE, Bruce JR
October 1977 52p ENV7623273
NSF/RA-770306 PB275220/NKS

This report describes an experimental investigation of the feasibility of simulating strong earthquake motion with contained explosive line source arrays. The technique consists of detonating a plane array of vertical line sources in the vicinity of the structure to be tested. In a full-scale test the array might measure 100x30 feet, consist of 10 to 20 vertical bore holes 30 feet deep, spaced on 5- to 10-feet centers, placed about 30 feet from the structure to be tested. Reusable hardware was developed for producing contained explosions in a 1/3-scale source, instrumentation was incorporated for hardware diagnostics and output measurements, reasonable acceleration and frequencies were obtained in soil with the 1/3-scale source, and repeatable results were demonstrated. Estimates based on the authors' current experiments show that in a 100-x30-foot array, a 5-Hz pulse with a 0.5-g peak acceleration can be produced with less than 100 lb of explosive. A complete train of oscillations typical of strong earthquake motion, with a total duration of 10 s and peak accelerations reaching 1 g, is estimated to require about 500 lb of explosive fired in 10 detonations.

697. Evaluation of the Effects of Traveling Seismic Waves on the Three-Dimensional Response of Structures (R-7720-4514)
Agbabian Associates, Engineers and Consultants
Werner SD, Lee LC, Wong HL
October 1977 161p ENV7502473
NSF/RA-770310 PB275869/NKS

Although usually not considered in design applications, the spatial variations of incident seismic wave motions may, under certain conditions, have a profound influence on the response of structures. A new methodology has been developed for analyzing the fully three-dimensional dynamic response of structures that are (1) above the ground, elastic, and have an arbitrary configuration; (2) supported on any number of rigid foundations of arbitrary shape that rest on the surface of an elastic half-space; and (3) subjected to input motions from body or surface waves with arbitrary excitation frequencies and angles of incidence. The superstructure is represented by a finite element model; foundation/soil interaction effects are analyzed using a continuum method. This report describes the general methodology and presents an example of its application to the analysis of a simple single-span bridge/soil system subjected to incident SH-waves. The analysis demonstrates the importance of traveling wave effects and the influence of different angles of incidence on the three-dimensional bridge response characteristics.

698. Survey of Existing Underground Water Pipelines with Emphasis on Their Seismic Resistance (Interim Grant Report IR-1)
Weidlinger Associates, Consulting Engineers
Isenberg J, Wright JP
July 1, 1977 31p ENVP769838
NSF/RA-770312 PB275214/NKS

A survey of the characteristics of underground water pipeline systems that may affect their seismic performance was conducted in order to (1) establish a data base on the types of water pipelines that are in current use, including materials, sizes, types of joints, depths of burial, and backfill conditions; (2) determine perceptions of seismic risk among water utilities; and (3) collect data on seismic performance of water pipelines. The survey questionnaire was mailed to 516 water utilities, including wholesalers and retailers, in the United States. This report includes discusssions of existing systems, perceptions of seismic risk, and experiences of damage in pipelines.

699. Development of Interference Response Spectra for Lifelines Seismic Analysis
Weidlinger Associates, Consulting Engineers
Nelson I, Weidlinger P
July 1, 1977 47p ENVP769838
NSF/RA-770313 PB275215/NKS

The authors contend that the dynamic response of a pipe network system may be determined by numerical integration of the appropriate equations of motion. An important criterion for failure of underground pipes subjected to seismic loading is the strain, or difference in displacement, between two points along the pipe. The concept of interference spectrum has been introduced to deal with this problem when dynamic effects are significant. The approach required to analyze a multidegree of freedom pipe network is outlined. The case of only two connected pipe segments is treated in detail and shown to be equivalent to a single degree of freedom system. The mathematical treatment is described in detail and the computer code developed is described. Numerical results are presented for both the El Centro 1940 and 15250 Ventura Boulevard 1971 input records. Results demonstrate that it may be possible to estimate, or at least bound, interference spectrum without actually computing it. Finally, it is noted that, for long periods, the absolute velocity spectrum is approximately the same as the pseudovelocity spectrum, which in turn is readily available for most earthquakes.

700. Strength Characteristics of Jointed Water Pipelines (Interim Grant Report No. IR-3)
Weidlinger Associates, Consulting Engineers
Salvadori MG, Singhal A
July 1977 86p ENVP769838
NSF/RA-770314 PB275216/NKS

This report is the result of a thorough survey of the literature on underground water pipes. It aims to establish a static "failure matrix methodology." Most of the data and examples are limited to cast-iron pipes of 4- to 36-inch diameters under static conditions. A general description of a typical pipeline network is presented, with particular emphasis on its geometric configuration and physical characteristics. Strength properties of typical pipeline and joint materials are described. A resume of test data on pipeline joints is given, along with a correlation of the test data with the results of elementary theory. Standard pipeline design methods also are described. Typical pipeline modeling data are presented, and typical entries needed for a static "failure matrix" are derived. The "failure matrix" establishes failure characteristics for various types of pipelines, depending on their geometric configuration, their materials, the materials of their joints, and their support, operating, and loading conditions.

701. Behavior of Underground Lifelines in Seismic Environment (Interim Grant Report No. IR-4)
Weidlinger Associates, Consulting Engineers
Weidlinger P
July 1977 25p ENVP769838
NSF/RA-770315 PB275217/NKS

The research attempts to formulate a comprehensive procedure based on a consistent theory for the analysis and design of underground lifelines in seismic environment. Current procedures of engineering seismology are not sufficient for this purpose, and the detailed definition of the displacement field due to seismic motion needs to be extended to include spatial and temporal variations in a broader frequency range. The displacement field may interact weakly or strongly with a buried pipeline, depending on the pipe's dynamic characteristics as modified by the surrounding soil. The effect of this interaction is presented in an "Interference Spectrum," which gives the peak response of a damped oscillator, subject to simultaneous excitation at two spatially separated points. Spectral amplitudes are used to determine the response of the system, in terms of a "Damage Matrix," which quantifies the failure parameters of a system consisting of various types of pipes, joints, and other details. For purposes of risk analysis, optimization, and cost-benefit studies of existing or planned systems covering large areas, a statistical method is developed which provides the expected value of free field gradients, as affected by subsurface and geology. These gradients are used to estimate the probable performance of the system during an earthquake defined by a Power Spectral Density function.

702. Seismic Shears and Overturning Moments in Buildings (Civil Engineering Studies, Structural Research Series No. 441)
University of Illinois at Urbana-Champaign, Department of Civil Engineering
Smilowitz R, Newmark NM
July 1977 145p AEN7508456
NSF/RA-770317 PB275678/NKS

Seismic force distributions for simplified computation of shears and overturning moment for preliminary design of buildings have been generated. A parameter study of the significant variables has been made to determine the applicability of the proposed distributions, which are intended to give greater accuracy than do existing procedures. The parameters studied involve the type of building, whether shear wall, shear beam, or a combination of the two, the uniformity of the structure along its height, the spacing of the lower modal frequencies, the fundamental frequency relative to the intersection of the constant velocity and constant acceleration branches of the response spectrum, the slenderness of the structure, and the shear wave velocity of the soil on which it is founded. The distributions should be applicable to the majority of structures of either frame, shear wall or combination of the two lateral resisting structural systems. The study methods and results are presented. Tabular and graphic materials are included.

703. Studies on the Seismic Design of Low-Rise Steel Buildings
University of Illinois at Urbana-Champaign, Department of Civil Engineering
Montgomery JC, Hall WJ
July 1977 181p AEN7508456
NSF/RA-770318 PB276733/NKS

The seismic analysis and earthquake resistant design of steel low-rise shear buildings, moment frame buildings, and x-braced frame buildings are studied. A number of two- and three-story buildings were designed according to the recommendations of modern building codes. The forces and deformations generated in the buildings under the North-South component of the El Centro 1940 earthquake were assessed by time-history analysis. The base story was found to be the critical link in the lateral seismic load resisting sytem for the shear buildings, the moment frame buildings proportioned with weak columns, and the x-braced buildings considered. Two simpler methods of analysis, the modal method used in conjunction with inelastic response spectra and the quasi-static building code approach modified to explicitly take inelastic behavior into account, were evaluated for use in calculating response quantities. The authors concluded that the quasi-static building code approach is the most appropriate procedure for the practical design of low-rise steel buildings of the types considered. Finally, the application of the study results to practical design is discussed.

Chemical Threats to Man and Environment

704. Investigation of the Feasibility of Tertiary Treatment of Municipal Wastewater Stabilization Pond Effluent Using River Wetlands in Michigan
Williams and Works
Sutherland JC
1977 171p ENV7620812
NSF/RA-770222 PB275283/NKS

The engineering feasibility of using Michigan river wetlands for tertiary treatment of municipal wastewater stabilization pond effluent was examined in relation to the alternatives of upland spray irrigation and chemical tertiary treatment. Seventy-five Michigan Southern Peninsula rural municipalities with populations ranging from 360 to 2,800, served by treatment ponds, and with proximal streams, were visited in aerial reconnaissance. Of these, 35%-40% are estimated to have a viable wetland alternative for tertiary treatment. The wetland method is estimated to be the most cost effective at pond-wetland distances less than four miles. The anticipated low or zero land cost and minimum of on-site hardware are favorable capital cost advantages. Operation energy consumption would be minimized by low site pressure-head requirements and the generally low-lying position of river wetlands. The potential capital cost savings in use of wetlands average approximately $320,000 (1977 dollars) relative to upland irrigation, and ap-

proximately $150,000 relative to chemical treatment. Discussion and meetings with personnel of the Wisconsin Department of Natural Resources have indicated positive interest in and potentially wide municipal application of treatment of wastewater using wetlands.

705. Missouri Lead Study, Volume 1 (An Interdisciplinary Investigation of Environmental Pollution by Lead and Other Heavy Metals from Industrial Development in the New Lead Belt of Southeastern Missouri, Final Report, May 1972 - May 1977)
University of Missouri, Interdisciplinary Lead Belt Team
Wixson BG, Bolter E, Gale NL, et al
1977 566p AEN7422935A01
NSF/RA-770263 PB274242/NKS

An interdisciplinary research team has studied trace contaminants associated with the production of lead for the past 7 years. The study areas are described along with a history of lead mining in Missouri, geology, mine and milling procedures, and lead smelting operations. The "New Lead Belt" is contrasted with century-old mining problems encountered in the "Old Lead Belt" district. Economic benefits are discussed regarding national and international mineral impacts. Research has determined the background values, established natural baselines, and evaluated the lead mining and smelting industry. Sources of trace metals in the environment were found to be associated with the mining-milling operations, transporting ores, and the smelter-refinery process. Information storage and retrieval systems are documented for sample handling. Analytical procedures for studying lead levels in deer bone are presented along with a summary of findings. Other advanced analytical studies for thallium and the use of Drosophila (fruit flies) as an environmental monitor are described. Volume 1 focuses on air quality, soils and geochemical studies, water quality studies, and water quality-biological aspects.

706. Information and Technology Transfer Program for the National Science Foundation
Environmental Quality Systems, Inc.
May 1977 30p ENV7618492
NSF/RA-770285 PB274259/NKS

The specific components of this study include (1) a review of the present technical outputs of the Chemical Threats to Man and the Environment (CT) Program; (2) a systematic categorization of all users of the CT program and the information transfer mechanisms used to reach users; (3) the development of lists of users in each category arranged according to the cognizant organization in the unit; and (4) the preparation of this report incorporating the products of all tasks into a format which guides the utilization of research results. A program is suggested to help coordinate delivery of information to the hierarchy of users identified as beneficiaries of the program. A

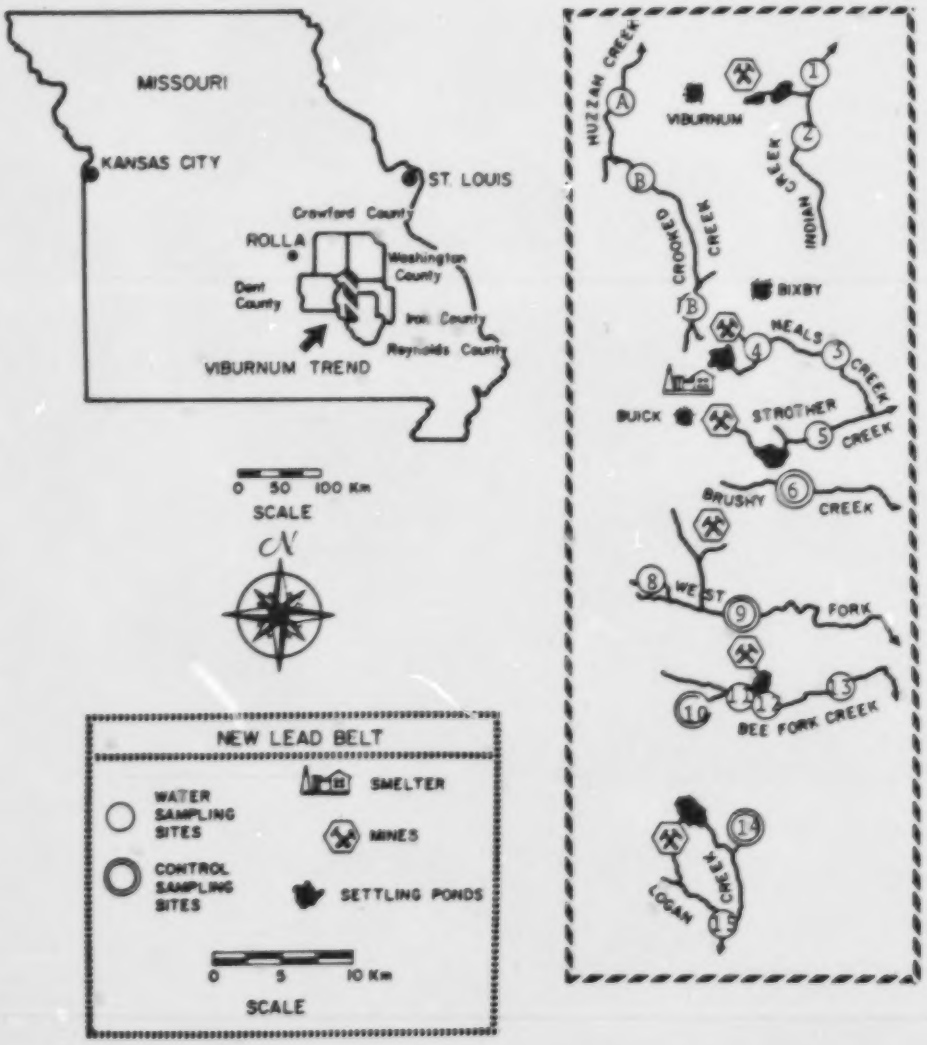


Figure 1. The New Lead Belt of Southeast Missouri

See Entry 705

Self-Correcting Information Transfer System (SCITS) is presented. User groups and information transfer media, short- and full-range program elements are discussed. The appendix includes sources for possible additions to user lists and abbreviations used in this report.

707. Chemodynamic Studies on Bench Mark Industrial Chemicals (Annual Report)
Oregon State University, Department of Agricultural Chemistry
Chiou CT, Freed VH
1977 43p AEN7617700
NSF/RA-770286 PB274263/NKS

The project attempts to (1) measure the basic physical and chemical properties and processes that govern the movement and persistence of industrial chemicals in the environment; (2) compile these properties for the selected "bench mark" chemicals and construct any structure activity relationships based on the available behavioral data; (3) predict the persistence and transport behavior for new chemicals from the measured properties in reference to the established structure-activity relationships; and (4) survey the literature on basic physical and chemical properties of selected "bench-mark" chemicals. The basic physio-chemical data include: aqueous solubilities S (3°, 20°, and 34°C), octanol/water partition coefficients K (20°C), and a resulting inverse linear relationship between log K and log S at 20°C; an inverse linear relationship between the partition coefficient and vapor pressure for aromatic hydrocarbons, organohalogens, aliphatic acids; evaporation rates of organic chemicals and water from a number of one-component and multicomponent systems.

708. Field Investigations of Convergences and Slick Concentration Mechanisms in Delaware Bay (Research on the Effects of Crude Oil Transfer and Upstream Refineries on Delaware Bay, CMS-RANN-1-77)
University of Delaware, College of Marine Studies
Sarabun CC Jr
1977 81p GI41896
NSF/RA-770307 PB275692/NKS

Field studies conducted in the channel north of the Delaware Bay lightering anchorage are discussed. Significant differences are found between the winter-spring season when only a single front occurs, and the summer-fall when multiple, internal waves appear on a persistent near-surface pycnocline. Although the data is not conclusive, some effects of variation in river-flow can be seen.

709. Nitrate in Effluents from Irrigated Lands
University of California
Pratt PF, Biggar JW, Broadbent FE, et al
July 1977 98p GI34733X
NSF/RA-770308 PB275673/NKS

Progress in the development of technologies for measurements of NO_3 leaching and denitrification and in our understanding of the factors that influence the quantities of nitrogen that go into various sinks is described. Research on various aspects of the nitrogen cycle in the soil-plant-water system is discussed, including: (1) nitrogen transformations with particular emphasis on denitrification; (2) crop utilization of nitrogen; (3) incorporation of nitrogen into and cycling of nitrogen in soil organic matter; (4) fluxes of water through the root zone; and (5) effects of soil profile properties on nitrogen leaching and denitrification.

710. Retrospective Assessment of Wastewater Technology in the United States: 1800-1972
Carnegie-Mellon University
Tarr JA, McMichael FC, McCurley J, et al
October 1977 380p ERP08870
NSF/RA-770351 PB275272/NKS

The investigators hypothesized that the period of the initial implementation of wastewater technology and the regulation of its impact bore a great deal of similarity to developments in the water quality field since the early 1960s. Through the methods of retrospective and prospective analysis, the development of the technology, its social and environmental impact, and the origins of regulation in regard to water quality have been traced. In addition, the method of analogy has been used to draw comparisons between key areas in the historical and contemporary periods. The study focuses upon technology development and implementation, impact in the health, governmental, economic and values areas, and the development of policy to deal with both implementation and regulation of water quality impact. Topics discussed in this document include the coming of water-carriage collection systems; the choice of separate or combined sewer systems; the application of wastewaters to the land; water quality policy conflicts; societal impact of wastewater technology; values and the technology; and the development of a federal role in water pollution control.

711. Retrospective Assessment of Wastewater Technology in the United States: 1800-1972 (Appendices)
Carnegie-Mellon University
Tarr JA, McMichael FC, McCurley J, et al
1977 133p ERP08870
NSF/RA-770352 PB275884/NKS

The investigators hypothesized that the period of the initial implementation of wastewater technology and the regulation of its impact bore a greal deal of similarity to developments in the water quality field since the early 1960s. Through the methods of retrospective and prospective analysis, the development of the technology, its social and environmental impact, and the origins of regulation in regard to water quality have been traced. Appendix A, "Philosophical Rationale for Retrospective Technology Assessment," examines the internal structure of technology, the dynamics of technological change, the interaction of science and technology, the role of values in a technology, and technology and organizational or social change. Appendix B, "Water Quality Law in the United States 1865-1920," focuses on the interaction of science and law in regulating American water quality. The general ideas underlying the common law of nuisance and the inherent policy power of governments are outlined. These doctrines and statutory law enactments throughout the 60-year period are traced. Appendix C presents an extensive bibliography for this study.

712. Evaluation of the Regional Activities Model (RAM) Developed at the Center for the Environment and Man, Inc., Final Report
University of Colorado, Graduate School of Business Administration
Frendewey JO Jr, Monarchi DE, Taylor RH
October 15, 1977 49p AEN7617062
NSF/RA-770372 PB275256/NKS

The Regional Activities Model (RAM) was developed to analyze the economic and environmental impact on a region due to population, employment, manufacturing, commerce, and service industries. The impact of four other energy consuming activities--space heating, electric power generation, vehicle-miles-of-travel, and incineration--is also analyzed. The levels of these activities are then used to determine the amount of pollutants (residuals) that would be generated within the region being investigated. This report presents an evaluation of the RAM and its associated models based upon computer runs on the CDC 6400 computer at the University of Colorado using Colorado-specific data and test data supplied by CEM.

713. Tunable Laser Spectral Survey of Molecular Air Pollutants (Final Report)
Massachusetts Institute of Technology, Lincoln Laboratory
Mooradian A, Pine AS
May 1977 116p AEN7101922A03
NSF/RA-770379 PB276188/NKS

The purpose of this program is to survey and catalog high-resolution near-infrared spectra of several hydrocarbons and other light molecules of atmospheric significance, using a unique difference-frequency laser spectrometer. Such spectra can be applied to the detection, spectroscopic identification and quantitative monitoring of molecular air contaminants. Monitoring sensitivity of laser systems is increased over conventional incoherent optical techniques because of the high spectral brightness of the tunable lasers which improves the capabilities for fully resolved, long-path absorption spectroscopy. The molecular spectral surveys and analyses presented in this report provide information on spectral signatures, absolute absorption intensities, and pressure and temperature effects on the spectrum of the molecules under observation. New high-resolution spectra of methane and formaldehyde in the region of their fundamental C-H stretching bands are presented, as is a precise theoretical analysis of the $4\mu m \nu_1+\nu_3$ combination band of SO_2 which can be used for atmospheric modeling. Also discussed are some instrumentation advances in the laser spectrometer system which improves its precision and data-handling capabilities.

714. Assessing Non-Point Source Pollution: A Detailed Study of a Rural Watershed in the Coastal Plain of Maryland
Smithsonian Institution, Chesapeake Bay Center for Environmental Studies
Beane M, Chirlin GR, Correll DL, et al
July 1977 64p ENV7622045
NSF/RA-770380 PB276178/NKS

This report shares with "208" planners, other land use and water quality managers, and citizens the findings of a detailed non-point source study on a rural watershed in the coastal plain of Maryland. These research findings have applicability to similar regions of the country and should provide insights into the magnitude and kind of non-point source pollution resulting from rural land use practices. Management recommendations based on these findings also are discussed. Major objectives of the study are to determine the magnitude of nonpoint source loading to an estuary from a rural watershed and the impact of this loading on water quality. Nutrient inputs and outputs were determined for each major land use in the watershed. Land use appears to be one of the most important variables influencing runoff composition and can be used with rainfall data to roughly predict the magnitude of nutrient loading from a watershed. This research focuses on (1) nutrient loading to the watershed; (2) nutrient concentrations in runoff; (3) sediment discharge; (4) bacteria (fecal coliform and streptococci in runoff); (5) heavy metals runoff; (6) herbicides in runoff; and (7) herbicide impact on aquatic plants.

715. Non-Point Source Studies on Chesapeake Bay, 2: Nutrients in Land Runoff from Rhode River Watersheds in 1975 and 1976 (CRC Publication No. 55)
Chesapeake Research Consortium, Inc.; Johns Hopkins University; Smithsonian Institution; University of Maryland; Virginia Institute of Marine Science
Correll DL, Friebele ES, Miklas J
May 1977 418p ENV7622045
NSF/RA-770381 PB276861/NKS

Part 2 of this project attempts to (1) measure the forms and concentrations of nitrogen and phosphorus in precipitation and land runoff for a series of Rhode River subwatershed basins; (2) relate these data to water discharge in order to obtain area yield loading rates; (3) assess how these area yield loading rates vary seasonally and yearly; and (4) relate area yield loadings to the land use composition of the test basins and to land use practicies in the basins. This study concludes that the annual average concentrations of total nitrogen and of total phosphorus in land runoff can be predicted by a simple statistical equation relating these concentrations to the percentage of watershed in agricultural plus residential uses. Also, it was found that the same equations were valid for the whole of the eastern and midwestern United States if soil pH was included as a parameter. A close relationship between land use and runoff composition is documented. The appendix, forming the bulk of the report, provides tables of nutrient concentrations in precipitation and in runoff waters from seven test basins.

716. Non-Point Source Studies on Chesapeake Bay, 3: Relationship Between Bacterial Contamination and Land Use in the Rhode River Watershed, and Survival Studies of Streptococcus faecallis in the Estuary (CRC Publication No. 56)
Chesapeake Research Consortium, Inc.; Johns Hopkins University; Smithsonian Institution; University of Maryland; Virginia Institute of Marine Science
Faust MA, Goff NM, Jackson AC
May 1977 133p ENV7622045
NSF/RA-770382 PB276862/NKS

In Part 3 of this project, the contribution of 983 hectare of rural watershed to the fecal coliform (FC) and fecal streptococci (FS) pollution in water runoff entering the Rhode River was examined. The survival of Streptococcus faecalis MC-5 of fecal origin in the Rhode River estuary, as affected by time, water temperature, dissolved oxygen, salinity and montmorillonite in diffusion chambers, was determined. As a result of this study the following conclusions were made: (1) The effect of basin characteristics was the same on FC and FS discharge and on water flow; (2) Fecal coliform pollution in runoff water varies with the seasons of the year; (3) The contribution of each land use component to FC and FS discharge in a multiple land use watershed can be calculated by the use of a statistical model; and (4) Water temperature

is the most important factor in predicting fecal streptococci survival from point and non-point sources in assessing water quality in an estuarine system.

717. Non-Point Source Studies on Chesapeake Bay, 4: Weekly Surface Hydrology of Seven Sub-Basins within the Rhode Island River Watershed, Calendar Years 1974-1975-1976 (CRC Publication No. 57)
Chesapeake Research Consortium, Inc.; Johns Hopkins University; Smithsonian Institution; University of Maryland; Virginia Institute of Marine Science
Chirlin GR
May 1977 64p ENV7622045
NSF/RA-770383 PB276863/NKS

In Part 4 of this project, weekly total precipitation, runoff, and their difference net input are tabulated for seven tributary sub-basins of Rhode River, Maryland, watershed. The data is discussed briefly; fuller treatment is available in Chirlin and Schaffner (1977). The limitations of a three rain-guage network to sample 982 ha over seven sub-basins are examined, and coefficients of variation up to 0.57 found for weekly precipitation totals above 2.5 cm.

718. Non-Point Source Studies on Chesapeake Bay, 6: Particulate Discharge from Rhode River Subwatersheds, 1975 (CRC Publication No. 59)
Chesapeake Research Consortium, Inc.; Johns Hopkins University; Smithsonian Institution; University of Maryland; Virginia Institute of Marine Science
Pierce JW, Dulong FT
May 1977 186p ENV7622045
NSF/RA-770384 PB276864/NKS

During Part 6 of this project, aliquots of composited flow-integrated samples of water passing through eight v-notch weirs located on different subwatersheds of the Rhode River, Maryland, were analyzed for total and mineral solids. The difference between total solids and mineral particles was allocated to the organic phase. Regression equations of solids discharge on water discharge showed that a second order equation was best for prediction of the concentrations of flow-integrated samples, in general explaining more than 80 percent of the variation in sediment discharge. Concentrations varied over three orders of magnitude, from less than 1 mg/l of total solids to 1290 mg/l. Precipitation was 81 percent of average in 1974; 132 percent in 1975, giving much higher water discharge in 1975. Most of the water discharge occurs during spring and fall. It is estimated that about 30 percent of the precipitation is discharged past the weirs by the streams. The discharge per hectare of total solids ranged from 1.3 Kg/ha to nearly 304 Kg/ha on a seasonal basis. Application of the derived rates to part of the data used in their generation indicated that such an approach cannot be used to predict sediment discharge, regionally or locally. Applied to the entire

Rhode River watershed, negative discharges resulted during two seasons and on an annual basis.

719. Non-Point Source Studies on Chesapeake Bay, 7: Metals Discharge from the Rhode River Watershed in 1975 (CRC Publication No. 60)
Smithsonian Institution; Chesapeake Bay Center for Environmental Studies
Wu TL
May 1977 203p ENV7622045
NSF/RA-770385 PB276997/NKS

This study attempts to (1) determine the water quality (metals composition) in the streams of the Rhode River watershed; (2) estimate the chemical loadings of certain metals due to land runoff from test watershed basins; (3) investigate the relationship between land utilization type and metals area yield; (4) determine the input sources of heavy metals in the runoff water; and (5) study the transport mechanism of metals. In order to study the effect of land utilization on the metals discharge to the receiving water, the land use analysis of each basin was compared with the metals discharge. The metals studied included iron (Fe), manganese (Mn), zinc (Zn), chromium (Cr), cadmium (Cd), copper (Cu), and lead (Pb). Potassium (K), calcium (Ca), and magnesium (Mg) were also intensively studied because of the large quantities applied to agricultural land as plant nutrients. Calculation of the area yield loading rate of a single land use category was attempted with a statistical modeling system. Small field size basins are now also used to derive area yield loading rates from each land use category. The authors attempt to correlate the area yield of the entire basin with percentage land use.

Alternative Biological Sources of Materials

720. Integration of Thermal and Food Processing Residuals into a System for Commercial Culture of Freshwater Shrimp (Power Plant Waste Heat Utilization in Aquaculture), Final Report, Volume 2 (July 1974 - October 1976)
Public Service Electric and Gas Company, Research and Development Department
Eble AF
December 1976 166p AEN7414079A01
NSF/RA-770047 PB276185/NKS

It has been demonstrated that all life-cycle stages of the tropical freshwater prawn, Macrobrachium rosenbergii, can be cultured successfully using waste-heat effluents of the Mercer Generating Station, Trenton, N.J. Further, high-density culture of the prawn is possible and practical. Rainbow trout (Salmo gairdneri) culture has also been successfully demonstrated utilizing the waste-heat discharges of an electric generating station. Animals can be reared at the same densities (1.7kg/1/min) presently used in commercial systems. Efficient systems have been designed for intensive annual two-crop production:

post-larval prawns are grown in indoor heated nurseries in early spring, placed in outdoor ponds in mid-May at sizes of 5-6cm, and harvested in late October as 11-12cm adults. Experiments culturing the American eel (Anguilla rostrata) in waste-heat discharge waters of the generating system have been successful. Volume 2 presents the research conducted in this study.

721. Integration of Thermal and Food Processing Residuals into a System for Commercial Culture of Freshwater Shrimp (Power Plant Waste Heat Utilization in Aquaculture), Final Report, Volume 3 (July 1974 - October 1976)
Public Service Electric and Gas Company, Research and Development Department
Farmanfarmian A
December 1976 193p AEN7414079A01
NSF/RA-770048 PB275870/NKS

The principal objective of this project is to develop procedures and methods for the commercial culture of the giant freshwater shrimp, Macrobrachium rosenbergii, and the rainbow trout, Salmo gairdneri, in the thermal discharge water of the Mercer Power Plant. It was used in a preliminary assessment of the survival, growth, and food conversion ratio of the mentioned aqua species. It was shown that acute or chronic exposure to power plant intake and discharge water, discharge with or without coal particles, and discharge with or without slurry overflow mix does not significantly affect metabolism, short-term survival, growth, or conversion efficiency of shrimp and trout. Volume 3 presents the research conducted in this study.

722. Appropriate Technology and Agriculture in the United States
Integrative Design Associates, Inc.
1977 29p ERS7621350
NSF/RA-770065 PB276055/NKS

The purpose of this report is to survey those in the United States currently active in the field of appropriate technology, describe their efforts, explore factors inhibiting the development and application of their innovations, report on their recommendations for Federal and National Science Foundation activities in support of appropriate technology, and assess the policy implications of appropriate technology. Survey respondents were 294 individuals and groups from target populations concerned with issues related to the environment, local participation in planning and technology development, and unemployment/income stabilization. This paper is a compilation of the major ideas of approximately 40 individuals and groups who responded to the survey primarily because of their interests in the agricultural dimension of appropriate technology. The open-ended survey elicited information about the scope of efforts of these people, the problems they face in moving from idea to application, and their recommendations for research and governmental activity in support of appropriate technology.

723. Enzyme Economics, Workshop Proceedings (October 15-17, 1975)
Bernard Wolnak and Associates
Wolnak B
October 1975 219p APR7518388
NSF/RA-770134 PB274923/NKS

This workshop seeks to define and assess the important economic factors associated with the use of enzymes in industrial processes and to provide pertinent information to the National Science Foundation for developing an effective and responsive research program in enzyme technology. Special attention is focused on the economic parameters of (1) use of the value-added concept in comparing enzymes with the inorganic catalysts; (2) determination of the factors that need to be considered and the problems that need to be solved before other enzymes reach a high level of commercial activity (cellulase, lipases); (3) exploration of some unmet industrial needs for enzymes (food, pharmaceutical, chemical) and exploration of the economic factors that have led to a significant level of use of a number of enzymes (rennin, glucose isomerase, amyloglucosidase); (4) exploration of the economic factors that have prevented the development of significant markets for a number of well-known, well-defined enzymes (proteases, lactase); and (5) evaluation of some of the economic potentials and feasibility for using immobilized enzyme systems in industrial processes.

724. Nitrogen Fixation with Photosynthetic Marine Microorganisms (Six Month Progress Report, February 15, 1977 - July 15, 1977)
University of Miami, Division of Biology and Living Resources, School of Marine and Atmospheric Science
Mitsui A
1977 25p AER7617159
NSF/RA-770293 PB274269/NKS

This research attempts to develop a system for the mass culturing of nitrogen-fixing marine photosynthetic microorganisms which could be applicable to commercial food and fertilizer production. Collection of marine blue-green algae has proceeded as scheduled. Several transfers of the algal cultures in nitrogen-free media have resulted in the establishment of photosynthetic nitrogen-fixing cultures. They display wide morphological diversity, which in many cases is coupled with fast growth rates in combined nitrogen-free media. Algal cultures in the process of isolation have been examined. The dominant algal growths in the nitrogen-free cultures are filamentous and colonial blue-greens. Algal associations with nitrogen-fixing bacteria are being identified. Indications of high species diversity have become apparent during the isolation processes. Several physiological characteristics of the samples have been determined. Salinity preferences, pH preferences, and growth rates are routinely determined on all samples. Each salinity/pH combination tested proved optimal for at least one algal strain. Laboratory equipment necessary for determination of nitrogen fixation rates has been built and/or tested. Preliminary tests of nitrogen fixation for some samples compare very favorably with other rates for blue-green algae reported in the literature.

Intergovernmental Program

State Government

725. Legislative Handbook on Energy-Related Topics
Fort Union Regional Task Forces
1977 60p ISP7610209
NSF/RA-770010 PB276766/NKS

This report highlights the activities of the seven task forces created by the States of North Dakota, South Dakota, Montana, and Wyoming to study the interstate effects of the Fort Union Coal Formation which underlies parts of each of these states. The task forces included legislators, executive branch personnel, academicians, representatives of Indian tribal nations, and citizens of each state. Topics studied included air quality, water quality, water allocation, plant siting, energy development, reclamation, taxation, and social and economic impact. The task forces examined methods to assist member states in problem-solving and acquainted the members with the energy development positions and accompanying laws and regulations of their sister states. Brief summaries of the research performed for each task and a list of the members in each group are presented.

RESEARCH REPORTS FROM PREVIOUSLY SUPPORTED

RESEARCH APPLICATIONS PROGRAMS

Energy Systems

726. Long-Run Incremental Cost of Electric Utilities, Final Draft Report
Ernst & Ernst
October 1977 214p APR7516666
NSF/RA-770335 PB276082/NKS

This project evaluated three methods for determining the marginal cost of electricity generation, transmission, and distribution. A description of the model developed during this project and the test results, as well as the methods used by two other researchers, is included. The model used a neoclassical approach for costing the generation of electricity. A production function is estimated and a long-run total cost equation is derived by minimizing cost subject to the production function and required outputs. The total cost function is then differentiated to arrive at the marginal costs. For transmission and distribution, as well as for customer sales, and administration and general costs, the authors used a statistical approach somewhat like that used by others. The two other methods are (1) time-differentiated marginal cost--developed by the National Economic Research Associates (NERA); and (2) marginal cost--developed by the Planning and Conservation Foundation (PCF). The utilities involved in the tests were the New England Electric System and the Missouri Public Service Company. Background and findings are presented in Part A. Detailed study results are included in Part B. Appendices in Part C provide additional information on the study results.

Fire Research

727. Prediction of Fire Hazard from Fabrics and Building Materials (Fifth Research Report)
Georgia Institute of Technology, School of Mechanical Engineering
Durbetaki P, Tincher WC, Lloyd LR, et al
February 28, 1977 270p AEN7203359A04
NSF/RA-770283 PB273977/NKS

The assessment of the fire hazard of a system requires a quantitative measure that characterizes the fire hazard, and a rational relation between the hazard and the relevant descriptions of the system and its environment. Probabilistic failure analysis was proposed as a rational measure of a system's fire hazard and is quantitatively expressed in terms of the probability with which use of a system leads to a prescribed loss. Measurements provide required data on thermophysical properties, constitutive description of processes, and ignition times. Description of the preignition processes and the prediction of ignition time were formulated and the results compared with measurements. Thermal radiative properties have been measured on both original and charred samples of cellulosic and thermoplastic materials. Using heating rates ranging between 20 C/min and 6000 C/min, materials were

pyrolized in a furnace. The measurements have indicated that ignition temperatures decrease with increasing pyrolysis heating rates. Ignition times have been measured on single and plane-parallel pairs of thermally thin materials and single thermally thick materials under different heating modes and exposure conditions. Modeling analyses have been carried out for single and paired thermally thin materials under radiative heating and single thermally thick materials under convective heating.

Weather Modification

728. Development of Organic Ice Nuclei Generators for Weather Modification, Final Report, Volume 1
University of Denver, Denver Research Institute
Fukuta N, Plooster MN
June 1977 144p ENV7302910
NSF/RA-770136 PB274952/NKS

The development of prototypes of ground and airborne organic smoke generators is addressed. The project reported here involves the development of three kinds of organic ice nuclei generators. Two supporting studies, one on the performance of supersonic nozzles to optimize the nozzle design, and the other on ice nucleation mechanims of organic smoke particles using a new thermal diffusion chamber, are included.

Non-Renewable Resources--Fossil Energy

729. Western Coal: Promise or Problem?
Cornell University, Department of Agricultural Economics
Tyner WE, Kalter RJ, Wold JP
August 1977 186p SIA7421846
NSF/RA-770291 PB274696/NKS

Public policies affecting the disposal of public domain lands for future coal production are examined. The study has two major parts. The first deals with micro or leasehold aspects of coal leasing--factors related to ownership patterns, logical mining units, leasing policies, end uses of coal (and the attendant impact on fair market value), and intertract competition questions. The second evaluates macro or leasing schedule aspects of western coal development. The pace of leasing through time and its location, as dictated by demand (magnitude and location), transportation economics, geology and production economics (by mining area) are examined in this section. The emphasis is on western surface mining possibilities since near-term economic conditions appear to favor their development over underground situations. Both analyses depend on a simulation model of private sector activity under alternative leasing situations and the

production cost and geological information derived for use in conjunction with that model. Chapter 2 presents a detailed description of the model. Chapters 3 and 4 cover production cost and geological information. Chapter 5 discusses the economics of western surface mining operations. The accumulated study results and those of related studies are used as a basis for analysis of coal leasing schedules under alternative leasing systems, public policies regarding institutional and economic leasehold issues, and market conditions.

730. Conversion of Model Coal Liquids Compounds to Naphtha Species (Final Technical Report, Bulletin No. 8)
University of Mississippi, Department of Chemical Engineering
Haynes HW Jr
May 1977 201p AER7203562
NSF/RA-770322 PB275891/NKS

Four catalysts were tested in a laboratory trickle bed reactor for their activities and selectivities in hydrocracking phenanthrene. All the hydrogenation products of phenanthrene, including high yields of perhydrophenanthrene, were observed in the products from experiments with alumina supported cobalt molybdenum sulfide. In contrast the hydrogenation over chromia-alumina was terminated at sym-ocatahydrophenanthrene. Hydrogenolysis reactions were also observed over these catalysts. The tendency was to successively hydrogenate and crack at terminal rings though some evidence of a minor reaction path involving saturation and cracking at the central ring was observed with chromiaalumina. A nickel-tungsten sulfide/fluorided alumina catalyst and a palladium loaded rare earth hydrogen Y zeolite catalyst were very active hydrocracking catalysts. The zeolite catalyst was extremely active and a pore diffusion limitation was evident. Approximate calculations indicated that the pore diffusion limitation was likely due to diffusion within the macropore structure rather than the intracrystalline diffusivity. In addition to these experiments the supported Group VIII transition metals (excepts Os) and a commercial zeolitye cracking catalyst were investigated in a pulse catalytic microreactor using a variety of hydrocarbon reactants. In all cases naphthalene derivatives were the most prominent cracked products obtained from cracking various partially hydrogenated phenanthrenes.

731. Enhanced Oil Recovery: The impact of Policy Options
Cornell University, Department of Agricultural Economics; New York State College of Agriculture and Life Sciences
Kalter RJ, Tyner WE
July 1977 29p SIA7421846
NSF/RA-770324 PB276763/NKS

Enhanced recovery processes are evaluated under the assumption of information certainty, using forecasts of production, price, and cost profiles for selected reservoirs. Alternative public policy options, designed to foster private sector development, are evaluated under this assumption. A second analysis, using subjective probability distributions of key input variables, is conducted in an effort to ascertain the impact of these and other policy alternatives designed for situations of uncertainty. The following potential public policy actions are analyzed and evaluated: (1) alternative regulated and/or market price levels; (2) price and/or purchase guarantees for enhanced oil production over the lifetime of a producing facility; (3) alternative taxation policies including considerations such as depreciation methods, investment tax credit rates, and expensing rules for various categories of investment subsidies or direct payment by the government of a percentage of private investment costs.

Exploratory Research and Technology Assessment

732. Failed Tendon Inspection via Monte Carlo, A General Evaluation Approach to Risk-Benefit for Large Technological Systems and Its Application to Nuclear Power (UCLA-ENG-7709)
University of California at Los Angeles, School of Engineering and Applied Science, Energy and Kinetics Department
Grzesik JA, Okrent D
January 1977 280p OEP7520318
NSF/RA-770053 PB276209/NKS

The reliability of tendons in containments of commercial nuclear power plants is examined. This research attempts to develop a method of examining the interrelationship between inspection frequency, tendon reliability, and containment availability, and to quantify the influence of required (or alternate) in-service inspection on availability, if tendon failure rate is taken as a parameter. The approach is to develop the Monte Carlo code that permits the user to input differing tendon failure rates, the criterion for containment unavailability, and differing inspection modes, including changes in inspection based on findings of previous inspections. This report includes (1) a description of the formulation of the Monte Carlo Computer code; (2) the results of some numerical examples; and (3) the detailed time-history of a Monte Carlo run in which failures are discovered and repair is instituted.

733. Alternative Work Schedules, A Technology Assessment
Haldi Associates, Inc.
November 1977 361p ERP7510594
NSF/RA-770303 PB276729/NKS

The need for assessment of the possible effects upon society of rearrangements and reductions in working hours emanated from the compressed workweeks of 4 and 3 days, flexible hours schedules (flexitime), protests by members of the women's movement against male-oriented work scheduling, and public policy regulations such as overtime. Six major steps were undertaken to make this assessment: (1) the technologies, or individual work scheduling arrangments, were carefully studied; (2) determinants of the various dimensions of scheduling (independent variables) were analyzed; (3) a model containing the more important variables that are considered most likely to affect future work schedules was specified; (4) the social impact areas and the relevant social impact variables within each area were identified; (5) connections and feedbacks between the social impact variables and the independent variables were studied; and (6) governmental policy options were developed. The study is primarily oriented toward the future with emphasis on the period between 1980 and 2000.

Renewable Resources--Crops

734. Developing an Energy Input-Output Simulator (AGNRG) for Analysis of Alternative Cropping Systems in the Corn Belt (Energy in Agriculture)
Purdue University, Agricultural Experiment Station
Muller RE, Peart RM, Parsons SD, et al
June 1977 46p AER7518726
NSF/RA-770126 PB274094/NKS

An Agricultural Energy Input-Output Simulator has been developed to evaluate alternative agricultural practices for energy efficiency in crop production. In this evaluation, it was necessary to determine how alternative practices would affect the productivity of the farm as well as to measure changes in energy inputs to the farm. Practices that reduce energy usage in one component of crop production might increase energy usage in another component or might significantly reduce crop yields and wipe out any gains in energy savings. The large number of intereffects between cultural practices and weather that affect energy use and crop output make a systems approach necessary. The simulator was used to evaluate the technical feasibility of several energy- saving practices and to compare them with conventional practices. Its results then were used to evaluate the economic feasibility of the practices in the Purdue Farm Managment Model B or a related farm management linear programming model. The simulator, which goes through the field operations of tilling, planting, etc., through harvesting, does this on the basis of actual weather data for a specific year. The crop yields are determined on the basis of the same weather data through the use of crop yield submodels.

735. Evaluating Energy-Saving Practices by Simulation (Energy in Agriculture, Presented at Energy and Agriculture Conference, Washington University, St. Louis, Missouri, June 16-19, 1976)
Purdue University, Agricultural Experiment Station
Peart RM, Doering OC
June 1977 6p AER7518726
NSF/RA-770127 PB274719/NKS

This paper discusses the corn harvest simulator which was developed to show farmers the effects of weather variability from one year to the next on their machinery requirements and their grain marketing strategy during and after the harvest season. An example of the information that can be generated by utilizing the Purdue corn harvest simulator is presented. The major feature of the simulator is that it uses a simple model of corn growth and maturity called the growing degree day method to estimate the date of corn maturity. It starts with an input planting date and predicts the date of maturity from the growing degree days accumulated using actual weather data. When a killing frost occurs before this maturity is reached, the model stops the corn growth, estimates the moisture content of the grain and the yield reduction due to frost. The model then dries the corn in the field according to a generalized field drying rate and begins harvest according to the input harvest moisture content. The simulator then operates on a day-to-day basis, harvesting corn if the weather records indicate that harvest was possible, drying grain at the rate specified, regardless of weather, but with the actual drying capacity tied to the field moisture content and the desired final moisture content.

736. Drying Energy from Corn Cobs: A Total System-1976 (Energy in Agriculture)
Purdue University, Agricultural Experiment Station
Horsfield B, Doster DH, Peart RM
June 1977 11p AER7518726
NSF/RA-770129 PB274718/NKS

This paper presents a discussion on the successful and economical use of corn cobs as drying fuel. It is proposed that corn cobs could provide the necessary fuel for drying corn if (1) there were sufficient energy in the corn cobs; (2) the cobs could be collected without interfering with harvest operations; (3) the cobs can be handled without additional labor or management requirements; (4) a satisfactory energy extraction method can be found which can put heated air into existing corn dryers; and (5) the above can be done in a way that is economically justifiable. Each of the above conditions is evaluated with appropriate data included.

737. Research Directed to Stable High Efficiency CDS Solar Cells, Final Report (NSF/RANN/AER7203478A04/FR/76)
University of Delaware, Institute of Energy Conversion
Meakin JD, et al
March 1977 80p AER7203478A04
NSF/RA-770072 PB276650/NKS

The power conversion efficiency of cadmium sulfide cells has been improved progressively during the course of the present contract. In the latter part of the final contract year, a group of 24 cells was made with an average conversion efficiency in sunlight of 6.84% and a maximum conversion efficiency of 7.64%. Only four cells had efficiencies below 4.4%. The improvements in conversion efficiency were largely the result of improved gridding and control of Cu_2S stoichiometry. During the report period, detailed investigations were made of various aspects of the Cu_2S formation and the effects produced due to storage of unprotected CdS/Cu_2S junctions. The production of higher voltage cells using the mixed cadmium zinc sulfide has made substantial progress. Cells were produced with open circuit voltages up to 0.7V. The overall efficiency of the cells was relatively low due to poor short circuit currents. It was shown that this was in part due to poor stoichiometry of the Cu_2S and lack of control on the Cu_2S thickness. Theoretical analysis was further refined with detailed studies of carrier density profiles in the Cu_2S penetration down CdS grain boundaries. The significance of the initial results on mixed sulfide cells was also explored.

738. Ocean Thermal Energy Conversion: Legal, Political and Institutional Aspects
American Society of International Law
Knight HG, Nyhart JD, Stein RE
1977 258p AER7500280A02
NSF/RA-770273 PB274123/NKS

The American Society of International Law panel was established to consider the legal and policy implications of the development of ocean thermal energy conversion (OTEC) technology under present and prospective domestic and international law. An overview of nonlegal issues, including the technical background of OTEC plants, and an economic assessment of OTEC are presented. Also presented is an evaluation of the international legal aspects (international jurisdictional issues involving OTEC installations); international political implications of OTEC systems; spatial and emerging use conflicts of ocean space; international regulatory authority concerning OTEC devices; and international environmental aspects. A discussion of United States domestic regulation and conflict management examines problems of legal responsibility and liability to be anticipated in OTEC operations; federal and state regulatory aspects of OTEC plants; domestic environmental aspects of OTEC; and legal aspects of financing ocean thermal energy plants.

739. Lightweight Building Materials for the Storage of Solar Energy (May 1975 - May 1977)
Massachusetts Institute of Technology, Department of Architecture
Johnson TE, Wellesley-Miller S, Andrejko D
September 1977 77p GI41306
NSF/RA-770326 PB275684/NKS

This project explores alternative thermal storage systems that also function as building elements. The storage system must respond well to both space conditioning and architectural needs for several building types. For high-rise construction, direct space heating offers the most architectural flexibility because weather-wall exposures are limited. With this approach, solar radiation is passed directly into the interior through south facing glazing. Case studies and computer simulations indicated that storing heat sensibly in concrete slabs conflicts seriously with space conditioning and architectural needs. Materials for storing heat latently in sunlit floor and ceiling polymer concrete tiles were developed. The polyester concrete tiles are charged with thin layers of phase change material that stabilize room temperatures and store large quantities of heat without using weighty materials which are expensive to support. The project is limited to concept development, feasibility studies, and experimental programs. This report documents (1) generalized design criteria and performance specifications for passive storage systems; (2) physical principles; (3) feasible solutions; (4) test assembly design experimentation and evaluation; and (5) full-scale simulation studies.

Symposium Proceedings

740. RANN 2, Realizing Knowledge as a Resource, Volumes 1-6 (Second Symposium on Research Applied to National Needs, Proceedings, Washington Hilton, Washington, D.C., November 7-9, 1976)
National Science Foundation
November 1976 749p
NSF/RA-770250SET PB275904/NKS

The National Science Foundation's Second Symposium on Research Applied to National Needs reflected the broad objectives of the RANN program of the NSF Directorate of Research Applications, predecessor of the present NSF Directorate for Applied Science and Research Applications (ASRA). The symposium addressed the relationship between science and society, and the application of scientific and technological knowledge for socially useful purposes. Volume 1 presents the plenary sessions and introductory materials, an overview of the symposium, and an appendix containing a list of speakers, special guests, attendees, films, and exhibits. The proceedings reported in Volume 2 concern selected areas of the renewable resources system. Volume 3 concerns (1) productivity in manufacturing, (2) industry-university cooperation as an approach to increasing knowledge about productivity, and (3) productivity in administrative services. Re-

search presented in Volume 4 concerns man's efforts to cope with natural and constructed environments. Volume 5 examines the role that science and technology can play in improving the capacity of state and local governments to respond to public needs. Volume 6 addresses four areas of national need: identification of the problems of regulating financial institutions; utilization of public policy to increase productivity; examination of the effects of regulation upon the economy; and the implications of regulation for the food industry.

741. RANN 2, Realizing Knowledge as a Resource, Volume 1: General Information and Plenary Sessions (Second Symposium on Research Applied to National Needs, Proceedings, Washington Hilton, Washington, D.C., November 7-9, 1976)
National Science Foundation
November 1976 101p
NSF/RA-770245 PB275905/NKS

See entry 740 for abstract.

742. RANN 2, Realizing Knowledge as a Resource, Volume 2: Using Natural Resources (Second Symposium on Research Applied to National Needs, Proceedings, Washington Hilton, Washington, D.C., November 7-9, 1976)
National Science Foundation
November 1976 112p
NSF/RA-770246 PB275906/NKS

See entry 740 for abstract.

743. RANN 2, Realizing Knowledge as a Resource, Volume 3: Improving Productivity (Second Symposium on Research Applied to National Needs, Proceedings, Washington Hilton, Washington, D.C., November 7-9, 1976)
National Science Foundation
November 1976 127p
NSF/RA-770247 PB275907/NKS

See entry 740 for abstract.

744. RANN 2, Realizing Knowledge as a Resource, Volume 4: Coping with Man-Made and Natural Hazards (Second Symposium on Research Applied to National Needs, Proceedings, Washington Hilton, Washington, D.C., November 7-9, 1976)
National Science Foundation
November 1976 179p
NSF/RA-770248 PB275908/NKS

See entry 740 for abstract.

745. RANN 2, Realizing Knowledge as a Resource, Volume 5: Improving Government Responsiveness to Public Needs (Second Symposium on Research Applied to National Needs, Proceedings, Washington Hilton, Washington, D.C., November 7-9, 1976)
National Science Foundation
November 1976 158p
NSF/RA-770249 PB275909/NKS

See entry 740 for abstract.

746. RANN 2, Realizing Knowledge as a Resource, Volume 6: Regulation (Second Symposium on Research Applied to National Needs, Proceedings, Washington Hilton, Washington, D. , November 7-9, 1976)
National Science Foundation
November 1976 72p
NSF/RA-770250 PB275910/NKS

See entry 740 for abstract.

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APPENDIX A

ASRA PROGRAMS IN BRIEF

The following is a summary in brief of the major program elements, objectives, and specific examples of research planned for support in the Applied Science and Research Applications (ASRA) program of the National Science Foundation.

INTEGRATED BASIC RESEARCH

The Division of Integrated Basic Research (IBR) is the division within the Applied Science and Research Applications Directorate which provides support for basic research that has a high relevance to major problems. This support will provide for increased funding for selected topic areas in the basic research directorates. Projects that will be considered for funding by IBR are initiated through the Foundation's basic research directorates. (Proposals should be submitted to the basic research programs in accordance with *Grants for Scientific Research*, NSF 78-41).

The Division is responsible for: (1) defining topic areas and related basic research disciplines; (2) stimulating research on the selected topic areas; and (3) assuring that funds are used as an add-on and do not displace support previously provided by the basic research directorates. The Division provides a direct link between ASRA and the basic research directorates.

APPLIED RESEARCH

The Division of Applied Research (AR) will provide an improved scientific understanding of a range of technical, social, economic and policy problems and increase the rate of technological innovation growing out of significant discoveries in various fields of science and engineering. By working closely with the disciplinary basic research programs throughout the Foundation, with public and private user groups, and with the scientific and engineering communities to which the Foundation relates, the Applied Research Subactivity is in a position to encourage and accelerate the application of basic scientific knowledge to a wide range of potential users.

Applied Social and Behavioral Sciences

The objectives of the Applied Social and Behavioral Sciences program are to provide an improved understanding of a broad range of significant economic, social, and technical problem areas and to suggest alternative solutions to these problems.

Public Policy and Regulation:

The objective of this program is to provide more and better information on policy issues of national concern such as unemployment, international trade, regulation, telecommunications, inflation and the use of scientific and technical information in judicial and administrative decisionmaking.

Public Service Delivery and Urban Problems:

Research will be supported that provides Federal, State and local government policymakers and managers, public interest groups, and other public and private voluntary associations with improved information on: (1) the changing character of urban areas in the United States; (2) the changing demands for services; (3) alternative mechanisms for improving governmental responsiveness to service needs; (4) improvements in the effectiveness and equity of service delivery by both the public sector and private market.

Industrial Organizations and Markets:

The focus of this program will be to provide an improved understanding of public and private processes, organizational structures, and policies as they relate: (1) to industrial organization and performance; and (2) to the effective use of human, capital, and natural resources within

the American economic system. These studies will apply research findings and methodologies developed in anthropology, industrial sociology and psychology, political science, and economics to such things as analyses of markets for natural resources, and examinations of the impacts of innovation in the manufacturing, distribution, construction and extractive industries on the structure of work and work incentives.

Individual and Group Processes:

Research in this area seeks to identify and stimulate the development of new technologies and technical processes growing out of discoveries in the behavioral sciences. Such activities often involve multi-disciplinary research groups from various fields of engineering and computer science, along with behavioral scientists working on applications ranging from such things as new technologies for the blind or other sensory deprived individuals to new communication and control devices for industrial applications.

Applied Physical, Mathematical, and Biological Sciences and Engineering

The objectives of the Applied Physical, Mathematical, and Biological Sciences and Engineering program are to increase the rate of technological innovation growing out of discoveries in various fields of science and to accelerate the application and use of these technologies to improve the breadth and quality of long-range solutions to significant social, economic, and technical problems and policy issues which confront the United States.

Physical, Mathematical, and Engineering Applications:

Research will be supported that seeks to facilitate the rate of technological innovations which hold promise for long-run improvements in industrial processes, materials availability and handling, and increased efficiency. A coherent research area initiated in RANN which builds on developments of computer-based technologies to improve the efficiency of production and manufacturing will continue. In addition, this area will be receptive to applied research proposals from the scientific community which build on fundamental research in such areas as catalysis, laser chemistry, and mathematics.

Biological and Ecological Applications:

Research in this area seeks to accelerate the rate of technological innovation based on basic advances in the biological and ecological disciplines, including exploring the potential of genetic manipulations for the economical production of new materials, the use of protoplast fusion to speed tests of new plant materials, and the modeling and management of ecosystems as a way of increasing our effective use of land, energy, and water and our renewable resources capabilities. It also seeks to provide information on the links between ecosystems and economic and social systems as a way of improving the information base for formulating public policies which affect our national resource capability.

Geophysical and Environmental Applications:

Research will be supported to accelerate the rate of technological innovations based on advances in the oceanographic and earth sciences. These include methods for exploring ocean resources, techniques for utilizing coastal and estuary areas for resource production, and the improvement of techniques and sensing devices for exploration and extraction of minerals from land areas.

PROBLEM-FOCUSED RESEARCH APPLICATIONS

The goal of the Problem-Focused Research Applications (PFRA) program is to apply United States scientific and technological capabilities to selected societal problems of critical national importance to assist in their clarification or resolution.

The common objectives of the programs within the Problem-Focused Research Applications Subactivity are to concentrate research and proof-of-concept experiments on selected problem areas in order to:

- Facilitate the incorporation of science as a working tool for problem resolution in the public and private sectors;
- Provide support for problem-focused research that bridges from basic research discoveries to application; and,
- Enhance the capability and capacity of nontraditional research users to employ research results and methods.

Earthquake Hazards Mitigation:

The objectives of the Earthquake Hazards Mitigation program are to develop methods and techniques that can provide effective protection from man, his works, and institutions from life loss, personal injury, property damage, social dislocation, and economic and ecological disruption associated with potential or realized earthquake hazards. The program is organized in three component areas: Siting, Design, and Policy.

Siting

The specific objectives of this research program are to:

- Develop a comprehensive data base on the nature of earthquake motion at typical construction sites and for representative structures;
- Establish the physical basis for characterizing the nature of earthquake motions and the dynamic forces generated by such motions and by other natural hazards;
- Develop capabilities for prediction of the magnitude and frequencies of ground motion;
- Develop a methodology for qualitative and quantitative estimates of local or regional risk associated with earthquakes and other types of hazards and combined hazards;
- Develop a comprehensive and unified program to improve geotechnical engineering practices applicable to soil dynamics, foundation design, failure and instability, and other aspects of earthquake ground motion; and,
- Identify procedurs for integrating information on natural hazards into land use planning; urban and coastal zone planning, offshore engineering and siting procedures.

Design

The specific research objective of this program is to:

- Improve the characterization of earthquake and natural hazard loadings necessary for the economical design of structures subject to dynamic loading;
- Develop new methods of analysis and design of buildings and structures of all types which will take into account nonlinear and inelastic behavior of materials and structures;
- Develop methods to assess the hazard potential and risk assessments applicable to existing structures and facilities, and devise innovative methods for improving performance within economically acceptable bounds;
- Obtain information for engineering analysis and design by observing the damage of facilities following actual earthquakes, and incorporate this information into standard design practice;
- Develop improved computational capability for dynamic analysis of structures and facilities and improve user access to any computer software which is developed;
- Develop model standards and design criteria for design of structures and facilities subjected to earthquake and natural hazard loadings; and,
- Conduct detailed studies of the behavior of smaller nonengineered structures and secondary components of buildings to improve recommended minimum analysis and design guidelines.

Policy

The specific objectives of this research program are to:

- Expand the base of knowledge on alternative social adjustments to earthquakes;
- Identify the social, economic, political, legal and related factors which facilitate or hinder the adoption of both social and technological solutions to earthquake hazards;
- Facilitate the beneficial use of earthquake hazard mitigation measures by devising effective techniques for disseminating information to the public and to decisionmakers at the local, State and National levels; and,
- Investigate measures which will reduce possible negative social, economic and political consequences of earthquake predictions and warnings.

Chemical Threats to Man and the Environment:

The Chemical Threats to Man and the Environment program supports research to increase our scientific knowledge of man-made contaminants and naturally occurring toxicants and to make this knowledge available to appropriate users. The objectives of the program are to:

- Define the exposure of ecosystems and human populations to chemicals and their conversion products by determining chemical pathways and transformations in the environment;
- Accelerate the application of recent discoveries in the basic sciences to the identification and measurement of environmental contaminants;
- Develop methods to enable us to predict the toxicological effects of chemicals on humans based on animal tests and other laboratory data; and,
- Identify contaminant effects on living forms critical for the functioning of whole ecosystems.

Alternative Biological Sources of Materials

The program element is directed toward alleviating national dependence on selected scarce resources by making alternative biological sources of materials available in the United States. The objectives of the program are to:

- Determine which biological sources constitute promising alternatives;
- Develop biologically based processes needed to convert the sources to useful materials; and,
- Determine the socioeconomic, technical, and environmental impacts of various proposed biological alternative systems on the country.

Science and Technology to Aid the Physically Handicapped

The Foundation is currently planning a program to focus science and technology on the problems of the physically handicapped. The objectives will be:

- to improve sensory capabilities, locomotion, and manipulative ability to compensate for losses due to handicaps;
- to investigate the social, economic and institutional barriers which inhibit full participation of the handicapped in society; and
- to study mechanisms to improve the availability of technological aids to the handicapped.

A formal program announcement will be released at a later date. NSF anticipates participation of universities, industry, small business and nonprofit institutions in the program.

INTERGOVERNMENTAL SCIENCE AND RESEARCH AND DEVELOPMENT INCENTIVES

The objectives of this program are to:

- Facilitate the integration of scientific and technical resources into the policy formulation, management support, and program operation activities of State and local governments; and,
- Test and evaluate selected incentives which the Federal Government may use to increase R&D investment in the private sector of the economy and to stimulate the acclerated introduction of innovative technology into commercial use where new products, processes, or services are needed in the national interest.

Intergovernmental Program

The primary objective of the Intergovernmental program is to facilitate the integration of scientific and technical resources into the policy formulation, management support, and program operation activities in State and local governments. The Intergovernmental program seeks to strengthen the public management capacity and capability of individual local communities and States in order: (1) to further the understanding of issues with significant scientific and technical components, and (2) to capitalize on the contributions of scientific and technical resources in the resolution of such issues.

Local Government:

The objectives of the Local Government subprogram are threefold:

- Facilitate the establishment of scientific and technological systems in individual local jurisdictions to further the understanding of science and technology as a major resource for local government problem solving and, at the same time, serve as catalysts for regional innovation groups;
- Promote the establishment of regional innovation groups to provide synergistic approaches to solving common problems

with scientific and technical components; and

- Establish national innovation networks to facilitate the development of periodic local government research and development agendas, to enhance market aggregation, and to provide communication networks and linkage mechanisms for the regional innovation groups.

State Government:

The objectives of the State Government program are to:

- Strengthen the public management capacity and capability of individual States through new and improved structures, processes, and procedures for integrating scientific and technical resources into their policy development and management support activities;
- Foster interjurisdictional cooperation on a regional and national basis in order to assist individual States in their capacity building efforts and to address cooperatively common issues of critical concern; and,
- Develop improved intergovernmental cooperation in the planning and implementation of national research and development agendas in order to ensure their relevance to State needs and to enhance the probability that research and development activities will have an aggregated market and be utilized.

Science and Technology Resources:

The Science and Technology Resources subprogram focuses on increasing the potential of various scientific and technical organizations to serve the needs of State and local governments and to mobilize such resources for meeting more effectively these needs. It differs from the local and State Government subelement in that the emphasis is on fostering the exchange of experience and lessons learned by these resource organizations in their attempts to supply scientific and technical expertise in meeting public sector needs.

Industrial Program

The Industrial Program considers unsolicited proposals to test and evaluate selected incentives to increase technological innovation and R&D investment in the private sector where new technology is needed in the national interest. It also supports research involving joint proposals of small business and other organizations and institutions, such as universities, associations, or large businesses, and research relating to improving the science and technology capabilities of fragmented industries, such as those with large numbers of small firms or industries that traditionally spend little on R&D.

PROBLEM ANALYSIS

The goal of the Office of Problem Analysis (OPA) is to identify and analyze major national problems with significant scientific content to provide a preliminary assessment of the appropriate role of science and technology, the Federal Government and the NSF in their resolution. The Office will support analyses of a wide range of potential research topics and problem areas for use in selecting future research directions for the Directorate for Applied Science and Research Applications.

To fulfill this goal, OPA will draw upon a wide range of expertise from the research community, professional and scientific associations, private industry, State and local governments and other user communities to help define the problem and determine research priorities.

It is anticipated that most of the resources of OPA will be dispensed in a procurement mode. However, the Office will consider unsolicited proposals for projects to analyze problem areas to determine applied research needs. These proposals should address themselves to providing answers to the following questions:

- What is the nature of the problem and what issues are researchable?
- Will new or additional research have a potential high payoff either through a better understanding of the problem or the development of a technical base which will contribute to its solution?
- What research is currently underway on the subject and what are its sources of support?
- What is the size and capability of the research community to address the problem?
- What is the most appropriate organization for supporting any additional research? Is there a unique role for NSF and ASRA?